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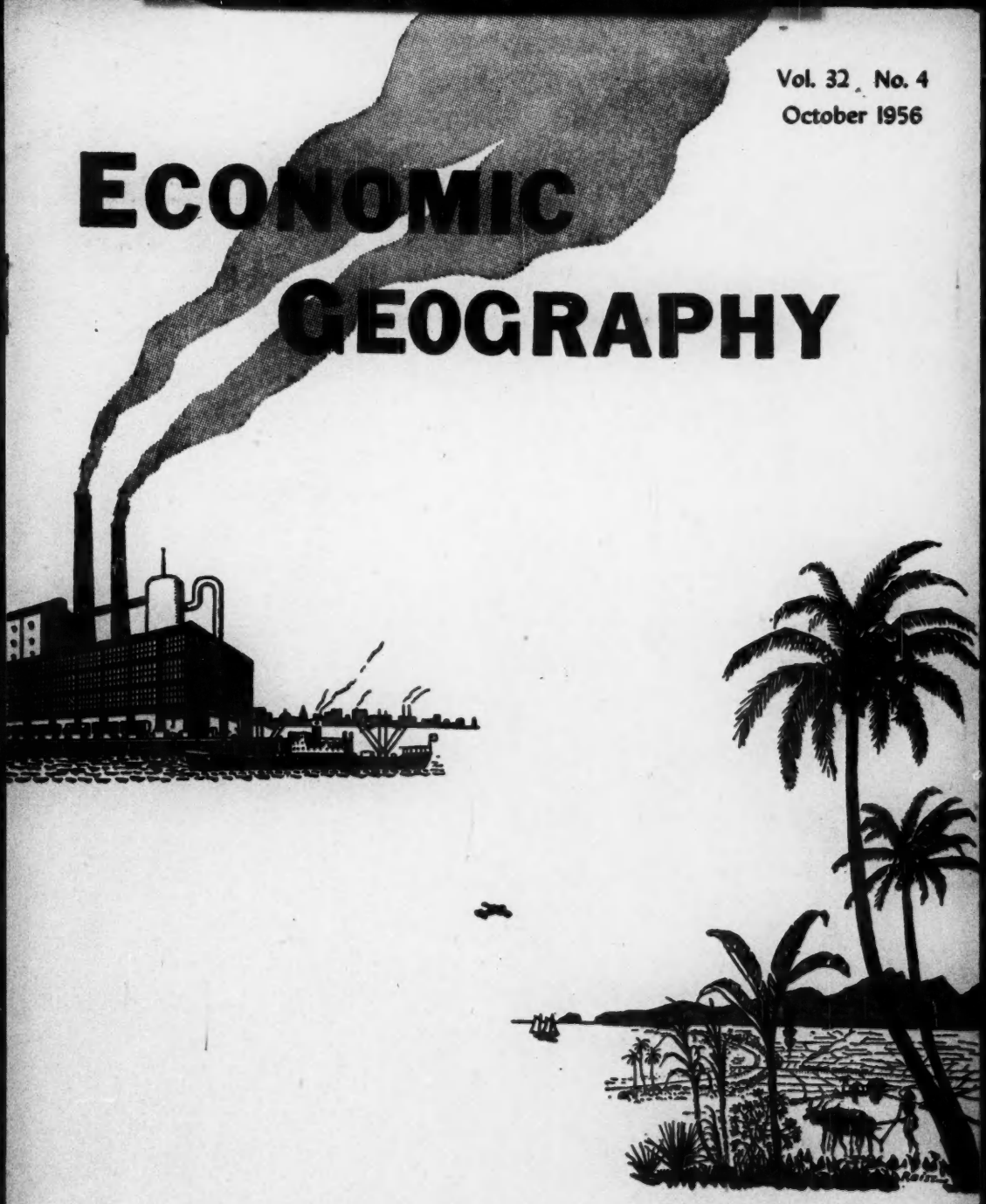

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ECONOMIC GEOGRAPHY

VOL. 32 OCTOBER, 1956 No. 4

MILLIONAIRE CITIES, 1955

Audrey M. Lambert

Dr. Lambert is Assistant Lecturer in Geography, London School of Economics.

TWENTY years have elapsed since Professor C. B. Fawcett's paper "Millionaire Cities (1935)" first appeared.[1] Since then the increasingly rapid growth of world population, combined with the spread of industrialization and the political and economic changes consequent upon the Second World War, has resulted in a major transformation in the distribution of great urban communities. The moment is therefore opportune for a survey of their present disposition and for an appraisal of the factors which have influenced the growth of the new entrants into this class of giant cities.

The objection is sometimes raised that no special significance attaches to the figure of a million for the population of a city. This may be so, but in considering the major concentrations of urban population some lower limit must be set. Moreover, the obvious world importance of the restricted number of cities to attain such size is reason enough for selecting them for special study. Again, criticism is occasionally leveled at the term *millionaire* city, but while purists may quibble at its use, the context normally makes its meaning sufficiently clear. In the sense in which Fawcett employed the term it meant a city or conurbation containing at least one million inhabitants. *Conurbation*, a word coined by Sir Patrick Geddes to denote "city regions" or "town aggregates,"[2] was subsequently defined by Fawcett as

> "an area occupied by a continuous series of dwellings, factories and other buildings, harbours and docks, urban parks and playing fields, etc., which are not separated from each other by rural land; though in many cases . . . such an urban area includes enclaves of rural land which is still in agricultural occupation," and frequently "extends beyond the municipal limits of the city on which it is focussed and from which it is named."[3]

The limits selected by Fawcett for conurbations outside the British Isles are not precisely known, but this presents no difficulty since the urban areas about the world's major cities have continued to expand with the building up of former open spaces and with improvements in suburban transport. Coincidence of the continuously urban areas of 1935 and of today would be

[1] B. Salamon and K. Kuchar, edits.: *Mélanges de Géographie offerts par ses collègues et amis de l'étranger à M. Václav Švambera*, Prague, 1936, pp. 52–57.

[2] Sir Patrick Geddes: *Cities in Evolution*, London, 1915, p. 34.

[3] C. B. Fawcett: "Distribution of the Urban Population in Great Britain, 1931," *Geogr. Journ.*, Vol. 79, 1932, p. 100; and *Mélanges de Géographie*, p. 52.

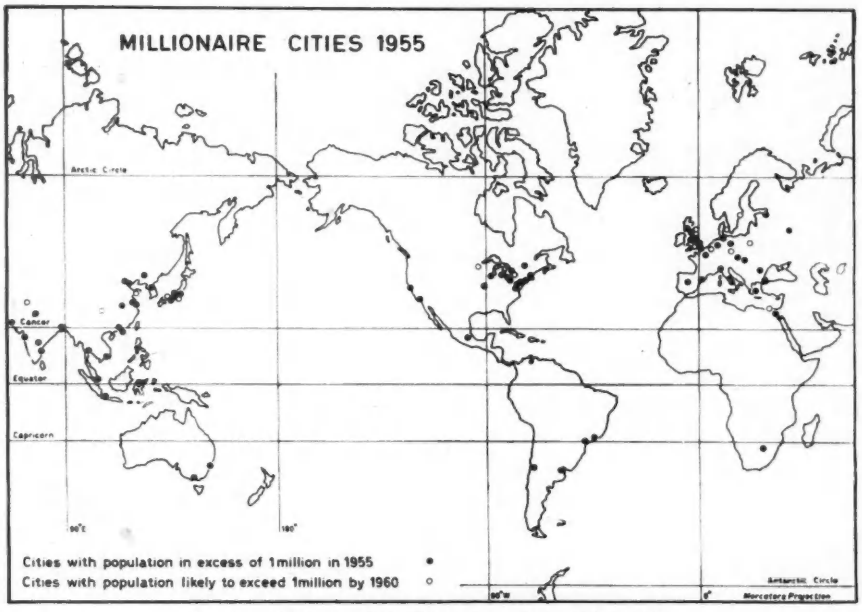


FIG. 1. Millionaire Cities (Actual and Potential) in 1955.

most unlikely. This paper follows current local practice in delimiting the conurbations. Thus, in Britain, those defined by the Central Statistical Office, in France "la grande banlieue" for greater Paris, and, in the United States, the "Urbanized Areas" delineated in the 1950 census, have been accepted.

The statistical sources are principally the census returns and official estimates for 1950 and 1951. Earlier figures have perforce to be accepted for Seoul (1946), Cairo and Alexandria (1947), although for these cities later unofficial estimates are available; while for the Soviet Union and China reliable recent census data are lacking. Since 1917, Russia claims the foundation of over 800 new towns, many of them in the industrial regions of western Siberia. Although no census has been published since 1939, the available evidence suggests that planning for administrative, political, and strategic reasons has consciously limited town size, and, while it seems likely that some have reached populations exceeding 500,000, none has attained the million mark. Figures for China, though available for a later period than for Russia, are suspect, and details of the 1953 census have not yet been published.

The present distribution of the eighty-odd millionaire cities is shown in Figure 1. They are listed in Table I. Those numbered in Column 2a had more than a million inhabitants in 1955, and there was every expectation that those in Column 2b would reach this size by 1960 if their present growth continued at the intercensal rate. Additions in the period 1935–55 are shown in Figure 2. Table II summarizes this information on a regional basis. Two features emerge—the increase of almost 50 per cent in the number of such cities within a span of only 20 years and the concentration of nearly two-thirds of this increase in Asia. The twentieth

century has seen a rapid rise in the number of cities of this magnitude. In 1900 there were but 11, by 1935 there were 56; there are now 83. The change in their distribution is, perhaps, even more significant. In 1935, Europe had nearly twice as many as Asia; now it has one less. The world pattern of great cities thus reflects more closely than in 1935 the world distribution of

TABLE I

MILLIONAIRE CITIES, 1955

1 Country	2 Number a*	2 Number b*	3 Names
EUROPE			
Great Britain	6	..	London, Manchester, Birmingham, Glasgow, "West Yorkshire," "Merseyside"
	..	1	"Tyneside"
Germany	3	..	Berlin, "Ruhr," Hamburg-Altona
Italy	3	..	Rome, Milan, Naples
Russia	2	..	Moscow, Leningrad
Spain	2	..	Madrid, Barcelona
France	1	..	Paris
Austria	1	..	Vienna
Hungary	1	..	Budapest
Greece	1	..	*Athens-Piraeus†*
Rumania	1	..	*Bucharest*
Turkey	1	..	*Istanbul*
Denmark	..	1	*Copenhagen*
Sweden	..	1	*Stockholm*
Belgium	..	1	Brussels
Czechoslovakia	..	1	Prague
Poland	..	1	Warsaw
AFRICA			
Egypt	1	1	Cairo; *Alexandria*
Union of South Africa	1	..	*"Rand"*
AMERICA			
United States	12	..	New York–N. E. New Jersey, Chicago, Los Angeles, Philadelphia, Detroit, Boston, San Francisco–Oakland, *Pittsburgh,††* St. Louis, *Washington*, Cleveland, Baltimore
	..	2	*Minneapolis–St. Paul, Buffalo*
Canada	2	..	Montreal, Toronto
Mexico	1	..	Mexico City
Brazil	2	..	Rio de Janeiro, São Paulo
Argentina	1	..	Buenos Aires
Chile	1	..	*Santiago*
AUSTRALIA	2	..	Sydney, Melbourne
ASIA			
China	7	..	Shanghai, Peking, Tientsin, *Mukden*, Canton, Hankow–Wuhan, Nanking
	..	2	*Chungking, Tsingtao*
India	5	..	Bombay, Calcutta, *Madras, Delhi, Hyderabad*
Japan	4	..	Tokyo, Osaka, Kyoto, Nagoya
	..	2	*Yokohama*, Kobe
Pakistan	1	1	*Karachi, Lahore*
Indonesia	1	..	*Jakarta*
Hongkong	1	..	*Hongkong–Kowloon*
Southern Viet Nam	1	..	*Saigon–Cholon*
Philippines	1	..	*Manila*
Siam	1	..	*Bangkok–Thonburi*
Korea	1	..	*Seoul*
Singapore	1	..	*Singapore*
	69	14	

*See text regarding distinction between actual and potential millionaire cities.
†Cities in italics are additions since 1935.
††See p. 13 in regard to Pittsburgh.

population. This correspondence is none the less still very imperfect. Europe, with less than half Asia's inhabitants, has almost as many millionaire cities; Africa and North America, with nearly equal populations, have three and 17 respectively, while Australia, with two, has under a tenth of Africa's population.

ASIA

The growth of Asia's cities is undoubtedly associated with the rapid natural increase of population within the monsoon lands, affecting urban and rural areas alike. Improved methods of controlling disease, better communications mitigating the effects of periodic famines, and, in the Indian sub-continent at least, a prolonged period free from internal warfare have all contributed. An increase in fertility rates is possible, though evidence for this is inconclusive, statistics indicating rather that a marked fall in the infant mortality rate has more than compensated for a slight decline in the crude birth rate.[4] The effects on the cities of this natural increase have been emphasized by a marked townward migration, brought about by rural poverty (itself in part a consequence of population growth); by the warfare and brigandage of unsettled political conditions causing refugees to seek the security of towns, and, most important of all, by the greatly enhanced prospects of employment offered there by expanding industry and commerce as a result of the gradual adoption of the techniques of Western industrial civilization. Furthermore, the achievement of independence by many Asiatic lands and the highly centralized nature of modern government tend to concentrate administration in a few state or provincial capitals.

Of the sixteen new "million" cities in Asia, China and India each has three, Pakistan two, Japan and Korea one apiece, whereas Southeast Asia, if we include Hongkong in this group, has six. Of these, Jakarta (formerly Batavia) exemplifies most clearly the factors mentioned above.[5] Probably the most rapidly growing of all these cities, its population rose from 500,000 in 1930 to nearly three million by 1955. The breakdown of the administration and the struggle for independence following the Japanese surrender caused many rural dwellers to seek the comparative safety of the city. Even with the attainment of self-government the depredations of extremist organizations swelled the number of refugees. Acute poverty drove many to the city where, settled in semi-rural kampongs within and around the built-up areas, they now gain a bare livelihood from occasional employment eked out by begging and by such poor crops as they can manage to raise. Intensification of these native village-type settlements along the roads about Jakarta and Djatingara and towards the port of Tanjoengpriok causes the urban area to merge imperceptibly into the surrounding, densely-settled countryside. Commerce and industry flagged during the strife with the Dutch but have since almost completely recovered. The port, handling international and local trade, and with its dry-dock facilities and associated foundries, forges and workshops, forms the major industrial district of the conurbation, which thus functions as the administrative, commercial, industrial, and cultural focus of the Indonesian republic.

Singapore and Hongkong owe their

[4] See Table 5, pp. 132–141, and Table 11, pp. 216–225, *United Nations Demographic Yearbook, 1953*, New York, 1953.

[5] D. W. Fryer: "The 'Million City' in Southeast Asia," *Geogr. Rev.*, Vol. 43, 1953, pp. 474–494.

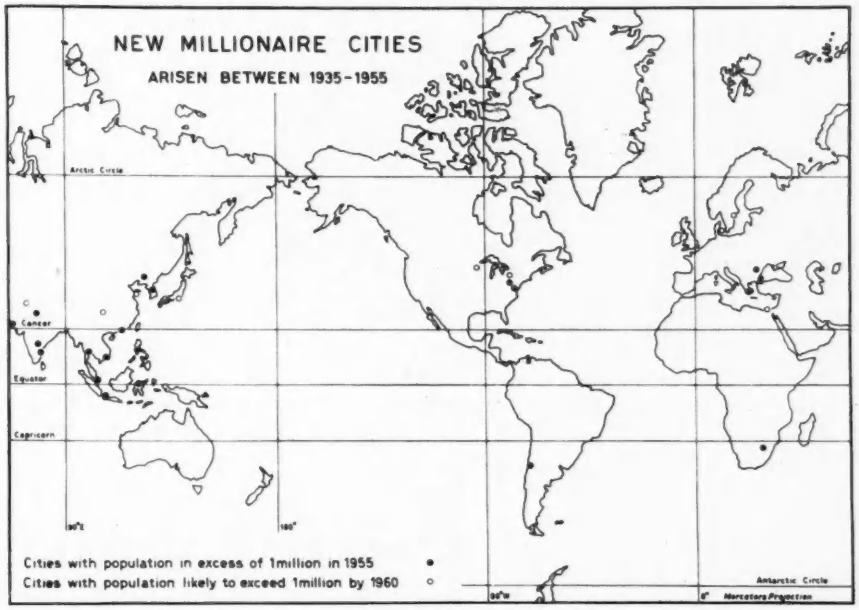


FIG. 2. The New Millionaire Cities (Actual and Potential) which have arisen in the 20 years since 1935.

growth primarily to trade. The former, despite its restricted hinterland, ranks as one of the world's great ports, having commercial ties with all Southeast Asia, the Far East, and Australasia. Hongkong, always an important point of contact with China, has become an even more vital trading link since the rise of the present régime. Its population has increased through the entry, both legal and illegal, of numerous refugees. Both cities are naval bases and administrative centers with growing manufacturing activities.

In the Philippines, Manila's post-war expansion reflects both planned industrial and commercial development based largely on the availability of generous dollar-aid reconstruction funds, and also a considerable city-ward movement of rural poor. Bangkok-Thonburi and Saigon-Cholon are essentially political and cultural capitals, though here also trade plays an important part and industry, if slight, is developing. War refugees have poured into Saigon, now both the administrative capital of Southern Viet-Nam and the principal French base in Indo-China. Bangkok's growth, by comparison, has been slower, probably because Thailand's rural areas are the most productive in Southeast Asia and have been less disturbed by war and civil strife. Primarily a seat of government, of considerable commercial importance, Bangkok's centrality in Southeast Asia (witness its selection as the headquarters of the United Nations Economic Commission for Asia and the Far East) may lead to further growth, provided the whole region can maintain its independence of the communist bloc.

Lacking the raw materials necessary for the establishment of heavy industry, the Southeast Asian states are too small

TABLE II

MILLIONAIRE CITIES (ACTUAL AND POTENTIAL)—NUMBERS SUMMARIZED BY CONTINENTS, ETC.

Location	*Millionaire cities in*		*Increase 1935-1955*	*Approximate % of world population in area (1950)**
	1935	*1955*		
Europe	23	28	5	23.3
Asia	13	29	16	54.3
N. America	13	17	4	9.0
S. America	4	4	..	4.6
Australia	2	2	..	0.5
Africa	1	3	2	8.3
World Total	56	83	27	100.0
N. Hemisphere	50	75	25	87.6
Tropics	7	14	7	23.0
S. Hemisphere	6	8	2	12.4

*Based on figures in W. S. and E. S. Woytinsky: *World Population and Production: Trends and Outlook*, New York, 1953.

individually to support giant urban communities acting solely as political and administrative capitals. Commerce has been the essential spur to the growth of the new "million" cities. The Chinese, forming an important, if not always welcome, element of their populations, are engaged in such trading activities, but the rise of these cities largely reflects the past commercial enterprise of the colonial powers.

Trade was undoubtedly instrumental in the development of Bombay and Calcutta, super-cities already in 1935, but was apparently of less moment in the rise of the five new cities of this class on the Indian sub-continent. The period to 1955 seems to have seen a subtle shift of emphasis in the factors influencing city growth. None of the five newcomers in India can rival Singapore and Hongkong as commercial centers nor, except for Madras, in industrial development; nor do they lie in those regions, as about Jamshedpur and Asansol, where industry has grown most markedly. But the part played by trade and industry must not be minimized; urban concentration throughout India was accelerated by war conditions and the spread of manufacturing, and has been further accentuated by the migrations following Partition (1947).[6] The cities newly arrived at millionaire status appear to have done so largely by virtue of their function as administrative centers. Delhi, formerly the imperial, is now the republican capital of India; Madras, Hyderabad, and Lahore are provincial capitals; Karachi, a port with growing industries, is now the chief city of all Pakistan. Industry is admittedly important in Madras, but Hyderabad, with its guardian British cantonment at Secunderabad, has little to account for its growth beyond its function as the focus of the semi-feudal territories of the Nizam of Hyderabad; whereas Lahore, which received many refugees after Partition, gains most of its prestige as the religious capital of Islam in the Pakistani lands.

In the rest of Asia only five new giant cities have grown up, all in the Far East. Three are in China, but the data for this vast country are so inadequate that Mukden (Shenyang) alone can definitely be assigned this rank, and the inclusion of Chungking and Tsingtao is only tentative. Mukden, a provincial capital and commercial center, has grown rapidly with the development of coal, iron,

[6] O. H. K. Spate: *India and Pakistan*, London, 1954, p. 114.

engineering, and chemical industries, and this growth will probably be further stimulated by the current drive for the establishment of heavy industry. Cotton, engineering, railway, and chemical works have contributed to the growth also of Tsingtao, port and trading center for a considerable hinterland in North China and the Shantung peninsula, but its development has been hampered by its restricted site and the competition of Tientsin. Choice of Chungking as provisional capital during the Sino-Japanese war and the consequent influx of refugees increased its population which, by 1947, was estimated to exceed a million. Later figures show a slight decline, but the probable expansion by the present government of the small local iron industry may now have reversed this trend.[7]

A few other Chinese cities may merit inclusion. They are Changchun (Hsinking), population 605,000 in 1946, and Harbin (Pinkiang), population 760,000 in 1947, both in Manchuria. Industrial expansion aided by Russian technicians is, it is claimed, proceeding rapidly here; population growth presumably keeps pace. In the south, Dairen had an estimated population of 1,054,000 in 1952, but, since the municipality covers 3400 square kilometers and includes Port Arthur, the city of Dairen alone must be much less.[8] Two other cities, Shihchiachuang (Hopeh province) and Sunyang (southern Shensi) are quoted as having over a million inhabitants,[9] but alternative estimates for both cities give populations under 250,000.[10]

[7] Directorate of Statistics, National Government, *The Statistical Monthly*, Nos. 125–134, Nanking, 1948.

[8] S. H. Steinberg, edit.: *Statesman's Yearbook*, 1953.

[9] J. Chesneaux: "Notes sur l'évolution récente de l'habitat urbain en Asie," *L'Information Géographique*, Vols. 13 and 14, 1949 and 1950, Paris, cites Shihchiachuang; Sunyang is listed in *The Statistical Monthly* noted earlier.

Seoul, in Korea, belongs primarily to the class of political and cultural capitals, with its population augmented by large numbers of refugees. In Japan another addition, of very different character, is Yokohama, a great port with a heavy concentration of industry including shipbuilding, engineering, silk, electrical, and printing works. Kobe, also in Japan, deserves mention. A potential "million" city in 1935, it reached that rank by 1940, but subsequent vicissitudes of war caused a decline to only 750,000 in 1950. Since then it has grown, but more slowly than its neighbors.

EUROPE

Compared with Asia, Europe presents a picture of relative stagnation. Whereas the great cities of Asia have more than doubled in number over the last 20 years, Europe has added but five to its total. Moreover, the rate of growth of the existing urban giants shows a marked decline, some cities even registering decreases of population. The Second World War has left its mark. Evacuation of urban dwellers to the safety and comparative plenty of the countryside, destruction of industrial plant and dwellings during the war, post-war housing and food shortages combined later with governmental attempts to prevent overcrowding,[11] have been instrumental first, in reducing urban population and, second, in limiting renewed townward movement. Some conurbations still fall below their pre-war population totals. The Ruhr has not yet recovered from the effects of Allied bombing; Warsaw—bombed, fought over, its crowded ghetto destroyed—is now but a potential instead

[10] L. E. Seltzer, edit.: *The Columbia Lippincott Gazetteer of the World*, New York, 1952.

[11] For example, in Britain the *Greater London Plan, 1944*, Sir L. Patrick Abercrombie, London, 1945, and the *New Towns Act, 1946*.

of an actual millionaire city, and Prague, though less severely afflicted, has also lost population.

If Fawcett's own definition of a conurbation (see p. 283) is accepted, his inclusion of Newcastle and Brussels in 1935 appears unjustified. Sunderland, which he included in Newcastle-Tyneside, is still (1955) separated from it by rural land, and official estimates for greater Brussels show a population of only 968,000 in 1952.

Stockholm, Copenhagen, Bucharest, Istanbul, and Athens-Piraeus exemplify the spread of urbanization and industrialization into regions previously little affected. All, save Istanbul, former capital of Turkey, are the political and administrative heads of their respective states, combining therewith cultural, commercial, and growing industrial activities. Each is the primate city[12] of its national territory, offering the best opportunities for employment and attracting the most energetic and ambitious in all walks of life.

North America

North America has added only five (Washington, D. C., Pittsburgh, Minneapolis–St. Paul, Buffalo and Toronto) to the number of its major conurbations. Of these additions, two (Minneapolis–St. Paul and Buffalo), have not yet reached the million mark; one (Pittsburgh) had probably already passed this figure by 1935. Although Fawcett omitted Pittsburgh from his list of millionaire cities it seems clear that the "continuously urban area" of the whole agglomeration then had well over a million inhabitants. But, even with these qualifications, the number of giant cities in North America has increased during the period 1935–1955 at a rate, in proportion to the continent's population, approximately twice that of Europe. The greater expansion in North America as compared with Europe reflects freedom from the material destruction of war and from the psychological impact of political betrayals and enemy occupation, coupled with abundant power, raw materials, and foodstuffs and a tradition of technological inventiveness. Symptomatic also of the transfer of political and commercial power across the Atlantic is the supplanting of London by New York–New Jersey as the world's largest conurbation.

Of the five additions, Pittsburgh, claimed to be the world's greatest iron and steel center and the commercial hub of its region, and Buffalo, transshipment point for ores and grain, belong to the thriving manufacturing belt west of the Appalachians. With heavy industry as the prime stimulus to their growth, they are akin to the cities of Manchuria in origin. Washington, by contrast, a consciously selected political capital, is comparable with Delhi. Minneapolis–St. Paul is the economic head of the states of the central northwest. In 1935 Fawcett doubted whether the inclusion of San Francisco–Oakland was justified, because of the physical separation of the two parts by the Bay. Since the building of the bridges linking San Francisco with Oakland and the north shore of the Golden Gate this question no longer arises.

All the great cities of the United States have shown continued lively growth, but those of Canada have been more static, for the eastern cities, while continuing to attract population have lost many potential immigrants to the rapidly developing prairie provinces. Even Toronto, one of the most prosperous cities in the Dominion, has only recently grown to full millionaire status

[12] Mark Jefferson: "The Law of the Primate City," *Geogr. Rev.*, Vol. 29, 1939, pp. 226–232.

although it was already a potential "million" city 20 years ago.

THE SOUTHERN CONTINENTS

In the remaining continents (South America, Africa, Australia) millionaire cities have increased by only two in the past two decades. South America shows no change, for though Santiago, capital of Chile, has now reached this size (industrialization being the key to its growth), São Salvador in Brazil is no longer in this class. The Second World War speeded up industrialization in the Latin republics, and the existing great cities, Buenos Aires (Argentina), Rio de Janeiro, and São Paulo (Brazil) grew rapidly. São Salvador (Bahia) could not offer such opportunities of employment as the two latter cities. Moreover, by 1955 more cotton and coffee was produced in São Paulo state than in Bahia—where they were formerly the principal crops—and labor from that area, always characterized by its mobility, emigrated in thousands to become the industrial proletariat of the cities of the southeast.

The two additions in Africa are Alexandria, a port with commercial ties throughout the Levant, owing much to the stimulus of the last war, and the Johannesburg-Rand conurbation, developed largely by white industrial enterprise, the native population providing the labor force. No other city of negro Africa can rival the latter in size, Ibadan (Nigeria) the largest of the indigenous cities having a population of under 500,000 at the 1952 census. With nearly two million inhabitants the Rand has a distinctly looser pattern of settlement than many older conurbations of the northern hemisphere. How far it is "continuously urban" is problematical, but allowance must be made for the difference of environment in the spaciousness of Africa. Similarly, some might consider that in the vast expanses of European and Asiatic Russia the rather open grouping of settlement about Dnepropetrovsk in the Donbas and about Stalinsk in the Kuznetz basin could be regarded as conurbations in the widest sense of the term.

Australia, like South America, registers no change in the number of giant cities since 1935, although time has further emphasized the striking concentration of population in the state capitals, which now hold over half the continent's inhabitants; the metropolitan divisions of Melbourne and Adelaide, for example, contain approximately 60 per cent of the populations of their respective states. This tendency to urban concentration has been exaggerated by the fact that seven in every eight of the 800,000 immigrants to Australia in the postwar years have settled in the towns instead of in the rural areas where it would seem they are most needed to ensure a balanced national economy.

LATITUDINAL DISTRIBUTION

Since Fawcett's survey the latitudinal range within which millionaire cities are found has remained unchanged. The most northerly and southerly additions, Stockholm and Santiago, are both equatorward of cities which had reached this size at the time of the earlier survey. More noteworthy, however, is the development within the tropics, where eight such cities have arisen, two in India, the rest in Southeast Asia. No comparable development has occurred in Africa or South America; indeed, the latter continent has even seen the decline of São Salvador from this rank. The three additions in the southern hemisphere, Santiago, Johannesburg, and Jakarta, serve only to

emphasize the much greater development north of the Equator, where 25 new "million" cities have grown up.

CONSEQUENCES OF URBAN GROWTH

The consequences of this urban growth may well be profound. New manufacturing areas compete with older centers of production; thus Lancashire which, even before 1935, was already suffering from the import of cotton cloth into Britain from India and Japan, now faces a much more serious threat from that quarter and from the new cotton mills of Hongkong. Again, the emergence of an urban working class entirely dependent on wages and at the mercy of world market fluctuations creates social problems requiring the most skillful administrative handling, if their exploitation for economic or political ends is to be avoided. The Rand mining district, where racial differences acerbate those arising between capital and labor, illustrates this kind of danger.

With world population increasing faster than world food production the fundamental problem facing all these cities in the future will be that of food supply. Urbanization seems likely to continue in the formerly underdeveloped areas of the world, especially Asia, but whereas the rise of great cities in Europe and North America was accompanied by rising living standards, such is not the case in Asia. China and India apart, the proved resources for the development of heavy industry are slight. Agriculture is primitive, yields low, and the masses live at or near starvation level. Production per agricultural worker compares unfavorably with that of all continents save Africa and falls well below the world average.[13] Continued urban expansion in Asia depends ultimately upon better utilization of the available land if living standards are not to fall still further. But new ideas spread slowly and population in town and country meanwhile continues to multiply.

URBAN SIZE: SOME LIMITING FACTORS

Compared with that of Asia, European agricultural and industrial productivity is high and increasing. Nevertheless, Europe's cities show a declining rate of growth over the past 20 years. Such slackening, albeit slight, may reflect merely a temporary check to normal development caused by the last war, but may also indicate that the limit of urban growth has been attained. This raises the question: What limits urban growth? The economic region on which a city or state can draw for its raw materials and markets is undoubtedly of first importance. Had world markets not been open to Britain in the past, London could never have reached its giant size. Fawcett asked: "What is the optimum proportion of urban to rural population in a closed economic area?" In the complexity of the modern world this query remains purely academic. Much depends on the natural resources with which individual states are endowed; few nations are completely self-sufficient. In western Europe, Britain and Belgium, their economies dependent on world-wide trade and industrially the most highly developed, support urban populations as high as 80 per cent of the total. By comparison, the United States and the Soviet Union, which could, if necessary, be self-

[13] United Nations Department of Economic Affairs, *Economic Survey of Asia and the Far East, 1950.* New York, 1951, Table 5, p. 71, gives the following figures for comparison:

Production per person engaged in agriculture in wheat equivalents in metric tons, 1947–8.

Asia	0.22
Europe	0.88
N. and Cent. America	2.57
S. America	0.48
Africa	0.12
Oceania	2.38
World	0.42

sufficing, have populations of which 60 to 70 per cent and 50 per cent respectively are urban. But if no state can afford a completely closed economy none has one that is entirely free. Political and tariff frontiers interfere with the free flow of trade and limit the areas tributary to great cities. In the past, political fragmentation and the nationalistic policies of European states have favored the growth of numerous state capitals, whereas in the absence of man-made barriers larger but fewer conurbations might have arisen. Similarly, within a single state, competition between neighboring town-groups may restrict their size.

Practical considerations also limit city growth. Sheer size alone raises serious problems. Local government costs rise disproportionately with increase of population above a certain critical level.[14] Transport difficulties multiply with increasing concentration of population; rush-hour overcrowding of public transport, lack of parking space, traffic congestion, etc., are problems common to most great cities. In 1935 Professor Fawcett saw no reason why greater London should not contain half England's population. Today, we see how transport difficulties, especially in the journey to work, may effectively check further expansion.

Limitation of city size has been attempted, especially in Europe, where bombing has underlined the vulnerability of great communities. But considerations other than strategy apply. Problems of securing an adequate water supply, as in Los Angeles, London, and Paris, have to be faced; disposal of sewage and urban refuse presents yet other difficulties, as in Jakarta, where the inadequacy of existing water supply and sewage disposal schemes for the greatly augmented population causes concern for public health. In industrial areas, too, the dangers of atmospheric pollution (witness the fatal London "smog" of December, 1952) are obvious. For these and other reasons planning authorities seek to alleviate city congestion by decentralization schemes such as the New Towns Plan for London and similar projects for the Paris region.

This paper has surveyed the distribution of millionaire cities in 1955, and particularly the changes over the past 20 years, notably in Asia. Reasons—historical, economic, social, and political—are suggested for the observed developments. City growth seems likely to continue in areas hitherto little affected, and it may progress at a declining rate in the older urbanized regions. The future of the world's great cities, especially the newer ones in Southeast Asia, is closely linked to the problem of food supply, but political, economic and practical influences will also play their part. The next 20 years will doubtless provide answers to some of the points examined above and may well raise further interesting problems for our consideration.

[14] R. M. Lillibridge: "Urban Size: an assessment," *Land Economics*, Vol. 28, 1952, pp. 346–348; W. A. Robson: *Great Cities of the World*, London, 1954, *passim*.

YUGOSLAVIA IN TRANSITION: INDUSTRIAL EXPANSION AND RESOURCE BASES

George W. Hoffman

Dr. Hoffman, Associate Professor of Geography at the University of Texas, specializes on Central and East Central Europe.

THE Federal Peoples Republic of Yugoslavia (Federativa Narodna Republika Jugoslavija) with a population of 16.9 million, occupies a transitional position between the Eastern Alps of Austria and the central part of the Balkan Peninsula and between the Pannonian lowlands and the Adriatic Sea (Fig. 1 and Table I). This location played a most important role throughout history and left distinct marks on the political, social, and economic development of the various regions of the country.

Yugoslavia has undergone many political and economic changes since its organization in 1918–19. None had more far-reaching results than those brought about by World War II. They resulted in a multi-national communistic state with close to 80 per cent of the population dependent upon agriculture. Much experimentation to solve the agricultural problems has taken place since the organization of the country and "industrialization" was the cure prescribed by every government during the last 36 years. Internal opposition and the huge task of building unifying economic and social conditions among the different people of this newly organized state slowed down progress in industrialization before World War II. But, starting with the government of Marshal Tito, industrialization became one of the basic principles upon which the new state embarked in governing the country.

The task set by the new Government after cessation of hostilities was enormous considering the backwardness of the people and the destruction of the country after six years of warfare. Large investments have greatly contributed to the establishment of new and the modernization of old industries. These industries are supplied by an increased domestic raw material output, and a transportation system which is constantly being enlarged and modernized.

Many questions must be answered in analyzing the causes and effects of this large-scale industrialization upon an agrarian society. This study deals with one aspect of this problem—a study of the resource basis of Yugoslav industries. The close relationship between raw material output, power supply, labor supply, and an efficient transportation system and the industrial production is self-evident. Detailed official statistics are now available, and publications by Yugoslavian and foreign scholars are increasing in scope. These, together with a survey trip by the writer in 1953 through the central and northern part of the country, make it possible to report both facts of actual industrial locations and to draw conclusions as to their effects on the economic geography of the country.

Pre-and Post War Economic Changes

Generally speaking, the prewar development was characterized by large

FIG. 1. The Federal Peoples Republic of Yugoslavia.

foreign capital investments[1] in Yugoslavia's mineral resources and the building of certain selected industries concentrating on primary production of domestic products. The transfer of profits of foreign investors after paying only a small tax had a detrimental effect on investments in Yugoslavia's own industries. The creation of employment opportunities by locating new industries or expanding existing ones was not of primary interest to foreign investors. Necessary metal and machine goods were imported from Western and Central Europe in exchange for agricultural products (wheat and maize, animal and animal products, wines and fruits), unfinished industrial products, and minerals.[2]

Yugoslavia's economy was brought to a standstill by the war. Destruction extended to industries, homes, transportation, and livestock. Over ten per cent of the country's people were either killed or expelled or were prisoners

[1] Karl Guenzel: "Die wirtschaftliche Entwicklung zwischen den Kriegen," in Werner Markert, edit., *Jugoslavien*, Osteuropa-Handbuch, Koeln/Graz: Boehlau Verlag, 1954, pp. 215–227. Mining generally was under foreign control: 48 per cent, British; 41 per cent, French; 5.5 per cent, Belgian. In the late 1930's German capital became more important.

[2] Research and Planning Division, Economic Commission for Europe, *Economic Survey of Europe in 1953*, Part III, Chapter 8: *Yugoslavia*, Geneva: United Nations, Department of Economic Affairs, 1954, pp. 106–109. Agricultural exports averaged between 40 and 50 per cent of the total exports in the inter-war years.

TABLE I

YUGOSLAVIA: AREA, POPULATION, AND URBAN CONCENTRATIONS, 1953

	Area (sq. km.)	*Per cent*	*Population and per cent*		*Capital, with population*	*Important cities with population*
Yugoslavia	256,588	100	16,927,275	100	Beograd, 469,988	
Serbia	88,200	34	6,983,544	41.3	Beograd	
Serbia Proper	55,700	21	4,460,405	26.4	Beograd	*Leskovacki, 115,700 *Krusevacki, 104,200 Nis, 60,700
Vojvodina	22,200	9	1,714,000	10.0	Novi Sad, 83,200	*Somborski, 133,440 *Pancevacki, 119,200 Subotica, 115,400
Kosmet	10,300	4	809,000	4.9	Pristina, 24,200	*Pecki, 64,391 *Zvecanski, 64,200 *Dakovicki, 61,630
Croatia	56,300	22	3,914,000	23.1	Zagreb, 350,000	Split, 75,400 Rijeka, 75,100 Osijek, 57,300
Bosnia and Hercegovina	51,600	20	2,843,000	16.9	Sarajevo, 135,700	Banja Luka, 37,800 Mostar, 31,600 Tuzla, 31,200
Slovenia	20,000	8	1,463,000	8.6	Ljubljana, 138,200	Murska Sobota, 94,000 Maribor, 77,100 Celje, 25,500
Macedonia	26,500	10	1,304,000	7.7	Skopje, 121,600	*Bitoljski, 121,700 *Tetovski, 89,278
Montenegro	13,800	5	420,000	2.4	Titogradski, 16,300	*Ivangradski, 70,000 *Niksicki, 46,513 *Bjelopoljski, 46,000

Source: Official Statistics.
*District figures.

who did not wish to return. Even though the capacity of individual industries, e.g., smelting industries and mining, was enlarged during the war, on the whole industrial production in December of 1945 reached only 30 to 40 per cent in the textile industry, 40 to 50 per cent in the food processing industries, and 15 to 20 per cent in the metal industries.[3]

Private property (including all foreign property) was confiscated shortly after the war by the new government of Marshal Tito. Nationalization of all productive activities became the official policy and worker's councils were put in charge of industries and businesses.

[3] G. J. Conrad: *Die Wirtschaft Jugoslawiens*, Sonderhefte, Neue Folge Nr. 17, Reihe A: Forschung, Deutsches Institut fuer Wirtschaftsforschung, Berlin: Duncker & Humbolt, 1953, p. 49.

Yugoslavia was extremely anxious to industrialize. This was not only because industrialization was a part of Communist ideology but also because the rural areas of the country could not support the overpopulation of their lands and industrialization, it was hoped, would bring relief to this serious situation.[4] In agriculture "collectivization" became the dominant slogan; at the same time much needed machinery was promised to the farmers.

INDUSTRIALIZATION OF AN AGRARIAN SOCIETY

As far as industrialization was concerned, an important base was available: raw materials and a large labor supply.

[4] W. Kuendig-Steiner: "Zum Industrialisierungs problem von Agrarlaendern," private distribution, Zuerich, 1953.

The real problem has always been their exploitation. Investment in the many industrial projects, unused water reserves, and great quantities of key raw materials presented a serious problem in pre-war Yugoslavia and is much the same in the post-war state. The basic theme of Tito's government throughout these years was clearly expressed as "industrialization under all circumstances," because according to the government's theory it meant quick economic independence and was the only way to make Yugoslavia a socialist state.

The Five Year Plan (1947–1951) was the basic instrument to accomplish the aims of this socialistic society.[5] Its expressed aim was the complete rehabilitation of the country, the organization of a modern Army, the organizing of a heavy industry, and production of an entire series of articles which Yugoslavia has not produced so far. The planners expressed a hope for changing the ratio between industrial and agricultural value of the total production from 45:55 in 1939 to 64:36 by 1951. Industries and transportation were assigned close to 68 per cent of the total amount invested.[6] This amount was spread over the whole country with the Federal Republics of Macedonia, Montenegro, and Bosnia-Hercegovina receiving the highest percentage. This was understandable, because these three Republics and especially Bosnia-Hercegovina had the largest unused reserves of water power and raw materials. Among the important plans contemplated under the Five Year Plan was the rapid enlargement of the iron and steel industry, the erection of numerous hydro-electric plants, the mechanization of mining, the use of local lignite for the production of coking coal, the modernization and additions in transportation, etc. All this it was hoped could be accomplished with the help of the USSR and its satellites who promised heavy machinery and other technical aid.

It was the expressed aim of the Government to develop facilities for processing the country's ores and if possible to export a sufficient amount for needed raw materials. The systematic surveying of the country and the discovery of new raw material deposits played an important part in the contemplated production increase. It was also hoped that the erection of new industrial plants and the enlargement and modernization of existing ones would satisfy all domestic demands and produce a small surplus for export. Heavy industries received top priorities and only during the decentralization campaign of the last two years has this emphasis slowly extended to light and consumer goods industries. It was realized that this last type of industry could make considerable contributions in employing the surplus population, especially in the many widely separated valleys of the mountainous core and the areas of densest population in Slovenia, Slavonia, and the Banat.

The break with the Soviet Union in 1948 forced Tito to alter his economic planning in a number of ways. The Five Year Plan (1947–1951) was spread over a number of additional years, some key projects were curtailed, others

[5] *Law of the Five Year Plan*, 1947–1951; Beograd: Jugoslovenska Knjiga, 1947, p. 129; Karl Guenzel: "Planwirtschaft und Aussenhandelspolitik der FVRJ," in Markert, Jugoslavien, *op. cit.*, pp. 228–235; *Economic Survey of Europe*, *op. cit.*, pp. 106–122.

[6] Distribution of Total Planned Investment 1947–1951 (percentages), quoted from *Economic Survey of Europe in 1953*, *op. cit.*, p. 110:

Electric Power	11
Mining and Metallurgy	11
Other manufacturing	20
Transport and communications	26
Agriculture	7
Other	25
Total	100

scrapped altogether.[7] The rate of investments had to be decreased from 30 per cent to 16.2 per cent in 1952 and 12 per cent in 1954. Machinery and raw materials from the East, promised and paid for, were never delivered and left many industrial projects unfinished. Certain vital raw materials had to be imported from the West and overseas, and considerable aid from the United States, the United Kingdom, and France assisted in re-orienting the country's economy.[8] Today Yugoslavia's economy is a planned socialist economy, almost completely decentralized and the profit motive and competition play an important role.

All in all industrialization has been more successful than any other sector in the economy. While the whole organization of planning and managing industrial production has been completely revamped since the break with the Cominform, basically speaking, the emphasis on industrialization was never changed. Yugoslav leaders constantly stress the experimental and transitional character of their economy.[9] "Decentralization" giving the initiative in planning, expansion, and investment, etc., to People's Committees, worker elected management councils, state, and even village units (communes)[10] was introduced two years ago. Incentives by permitting the factories and other enterprises to operate independently, was then the goal. A recent change reintroduces the concept of work norms. Workers' council, people's committees, management committees, and the trade unions are going to set "individual wage scales for jobs and classify the employees for them." It is now hoped that this new system will "guard against excessive profit and pricing by enterprises," and would also increase productivity.[11] The Government is stressing that low productivity would leave the plants less money for reinvestment, less for taxes, and less for the wage fund from which the workers receive certain percentages for the profits made during the year.

The Federal Government today lists basic production goals. In this they assume that certain products will be produced and this is based on certain available statistics and various plans of the republics and village and factory units. It does not set production goals. The system is relatively new and only the future will tell how successful.

[7] Until the break Yugoslavia imported from the Soviet Union and the other Peoples' Democracies all coke, 45 per cent of its fertilizer needs, all steel tubing, 60 per cent of her petroleum needs, etc. See also K. C. Edwards: "The Yugoslav Economy," *Geogr. Rev.*, Vol. 44, 1954, pp. 425–428; Herwig Lechleitner: "Die Industrialisierung Jugoslawiens," *Mitteilungen der Geographischen Gesellschaft Wien*, Band 94, Heft 9–12, pp. 380–383; Otto Matter: "On Yugoslavia's Industrialization," *Swiss Review of World Affairs*, I, II, (February 1952), pp. 11–13; and a series of statements by Marshal Tito, D. Radosavljevic, E. Kardelj, and others, *Yugoslavia: Progress of the 5-Year Plan*, Washington, D. C., Embassy of the Federal Peoples Republic of Yugoslavia, 1949, p. 48.

[8] Total economic aid from the West starting with UNRRA amounted to $1,084,000 and $500 million in United States military aid since 1951. See also *Foreign Operations Administration*, Monthly Operations Report, Washington, July 31, 1954; Svetozar Vukmanovic-Tempo, "Some Basic Characteristics of Economic Development in Yugoslavia," *Yugoslav Review*, Vol. 4, No. 2–3, 1955, p. 23, and "Tito Seeks to Lift Living Standard," *The New York Times*, January 4, 1956, p. 85.

[9] Dusan Calic: *Planiranje privrede FNRJ* (The Planning of the Economy of the Federal Republic of Yugoslavia), Zagreb: Nakladni zavod Hrvatske, 1950; Fred W. Neal: "The Reforms in Yugoslavia," *American Slavic and East European Review*, Vol. 13, 1954, pp. 227–244; Vladmir Velebit: "Yugoslavia on her way toward a Socialist Democracy," *International Affairs*, Vol. 30, 1954, pp. 155–165; "New Ways of Yugoslav Economy," *Yugoslav Review*, Vol. 5, No. 8–9, 1955, pp. 3 and 12–13; also proceedings of 1954 Party Congress, specifically the statement by Vukmanovic-Tempo.

[10] Jovan Dordevic: "From Local Self-Government to Communes," *Review of International Affairs*," Vol. 109, pp. 13–15 and Vol. 110, pp. 13–14; Radivoje Petkovic, *Local Self-Government in Yugoslavia*, Beograd, Jugoslavija, 1955, p. 115.

[11] *The New York Times*, "Belgrade to Set Workers' Norms," March 18, 1955.

Also added to this should be the significant fact that a large percentage of gross investments and almost half of the net investments are being made directly by the Federal Government—the so-called key-projects—while the rest is made outside of direct control of the federal government.

The Resources Bases[12]

Among the important resources which are available in the planned industrialization of the country are raw materials, unused water reserves, and a considerable untrained labor force. The reserves of raw materials had to be carefully surveyed and mines were in great need of modern machinery. The utilization of water, especially in the mountainous core of the country, requires a large amount of capital. The planners well realized the havoc power shortages could play and therefore gave early attention to increase the power supply.[13] While labor supply is abundant, less than 15 per cent of the available labor force is in its most productive years, between 25 and 49 years of age.[14] The war has left its marks here and this is felt in the expanding economy. The training of engineers, foremen, and other technical workers is the most urgent problem, and special attention is given to reducing the illiteracy rate. Transportation is the big bottleneck and next to heavy industry has received the largest amount of investments since the beginning of the Five Year Plan.

Raw Materials

With the exception of bituminous coal Yugoslavia is among the richest raw material countries in the world (Fig. 2). Close to 82 per cent of the coal reserves are in lignite and 17.8 per cent in brown coal, while only .2 per cent are bituminous coal. The mines in Bosnia and Hercegovina today account for 37 per cent of the total production of the country and have nearly tripled production since 1939. Close to two-thirds of the reserves are located in Bosnia, and one-third in Serbia, even though 21 per cent of the production still comes from Slovenia, which has less than 4 per cent of the country's coal reserves. The shortage in Carboniferous coal is a considerable handicap in the development of a steel industry and imports are essential. Coal production on the whole nearly doubled since 1939 but production of bituminous coal actually decreased. The brown coal and lignite mines of Kreka near Tuzla, Banovici, Kakanj, and Breza in central Bosnia are the largest in the country. Serbia, which in 1954 produced close to 25 per cent of the country's total, produces some bituminous coal, but its largest production comes from the brown coal mines of Aleksinac, Despotovac, Vrdnik, and the old Kolubara basin (Tables II and III). Mention should also be made that close to 11 per cent of the coal output came from strip mines, a percentage which it is hoped may be increased further.

In the last few years coking plants were erected in Lukavac and Zenica

[12] Material for this section has largely been taken from the following sources: Markert, *Jugoslawien, op. cit.*, pp. 254–279; Anton Melik: *Jugoslavija*, Ljubljana, Knjiga Obsega, 1949; Anton Melik: *Yugoslavia's Natural Resources*, Beograd, Publishing and Editing Enterprise "Yugoslavia," 1952; *Economic Survey of Europe, op. cit.*, pp. 106–122.

[13] Obviously the building of new power stations and the laying of cables goes much slower than the building of new industries. As a result of this, local power shortages, especially in Serbia and certain sections of Bosnia, have been common during the last few years. Present plans call for several new power stations and transmission cables which it is hoped will solve power shortages.

[14] Gunther Ipsen: "Wachstum und Gliede rung der Bevoelkerung Jugoslawiens," in Markert, Jugoslawien, *op. cit.*, pp. 55–58.

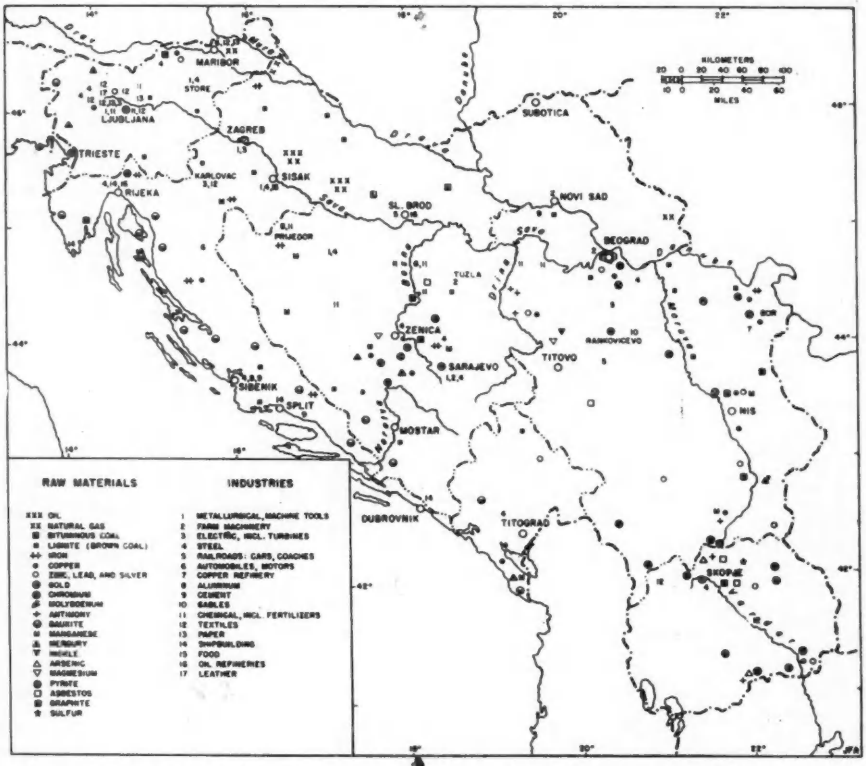


FIG. 2. Yugoslavia: Industrial locations and raw materials. (Compiled from official sources.)

in Bosnia and Sisak in Croatia.[15] These plants hope to use more and more local brown coal and lignite and produced over 400,000 tons of coking coal in 1954. But with increasing steel production there is a continuing need for imported bituminous coal.

Since 1939 the production of petroleum and natural gas has considerably increased, centering in the region of Dolnja Lendava, Slovenia, and Gojilo, Croatia (Table IV). Test drilling is also going on in the Banat and several other regions. Only natural gas has been found up to the present time in these new areas. Yugoslavia also has considerable oil bearing shale and extraction is going on near Sleksinac in eastern Serbia. Refineries have been built in Rijeka, Sisak, and Bosanski Brod and imports of many by-products and specialized oils have been considerably reduced.

The mining of ores always played an important role in Yugoslavia. Ore fields are well distributed in the Dinaric mountain region and increased discoveries are further adding to the reserves.

Iron ore deposits are numerous and estimated reserves reach 500 million tons, proven reserves 145.5 million tons,

[15] Alex N. Dragnich: *Tito's Promised Land Yugoslavia*, Rutgers University Press, New Brunswick, N. J., 1954, p. 232, is highly critical of Yugoslavia's experiments of coke made from lignite.

TABLE II

YUGOSLAVIA: HEATING RESERVES AND PRODUCTION

	Estimated reserves, 1953		*Production, 1954 In 1000 metric tons (mt), million kwh or cubic meter (m³)*
	Per cent	*Reserves*	
Bituminous Coal	0.2	100 mill. mt	.980 mt
Brown Coal	17.8	1,800 bill. mt	7.100 mt
Lignite	82.0	18,000 bill. mt	5.565 mt
Total	100.0	19,900 bill. mt	13.645 mt*
Crude Oil	25.0	14,300 bill. mt	.216 mt*
Natural Gas	4.0	25,000 bill. m³	90,130.00 m³
Oil Shale	71.0	40.5 mill. mt	.....**
Total	100.0	.....	.....
Heating Timber	.....	850 mill. m³	28 mill. m³***
Water Power	.....	12 mill. kwh	1.8 mill. kwh***

*Planned under 5-year Plan of 1946: 16.5 mill. metric tons by 1951: 450,000 metric tons oil by 1951.
**No information available.
***1953 figure.
****In addition 1.6 mill. kwh thermal power.

Sources: Compiled from: Official Yugoslavian Statistics
Information collected while in Yugoslavia
Mid-European Studies Center, 1954
Werner Markert, *Jugoslawien*, Osteuropa-Handbuch, Koeln-Graz: Boehlau-Verlag, 1954

with an average iron content of 50 per cent. The center of mining at present is near Ljubija and Vares in Bosnia, which also contains two-thirds of the country's present estimated reserves (Table V). The ores are being shipped directly to the main steel producing industries discussed later.

The abundance of a whole series of ores contributes greatly to the whole economy of the country. Before the war most of these ores were smelted in foreign countries but as part of the Five Year Plan smelting of local ores has greatly increased. The well-known copper ores of northeastern Serbia in Bor and Majdanpek are being mined in increasing quantities with American financial aid contributing to the modernization of mining equipment.

The biggest and best-known lead mines are in Trepca in Serbia, Mezica in Slovenia and Zletovo in Macedonia. Considerable reserves and a constantly increasing production make this one of the country's most valuable ore deposits. Between 1950 and 1953 the export of these ores contributed, on an average, 9 per cent to the value of exports—most of that to the United States—and made them the most important single export item. The ores contain roughly 5–6 per cent lead, 3–4 per cent zinc and 120 grams of silver. Production which has nearly doubled since 1939 covers all domestic needs and makes Yugoslavia number one in the production of all of Europe.

Other important ores include chromium mined in Macedonia, southern Serbia, and Bosnia; manganese with the largest mine near Cevljanovic in Bosnia; the rare ore molybdenum mined in eastern Serbia near Mackatica; antimony, very widely distributed and exported in the main to the United States and western Germany; mercury, mined in the former Italian territory near Idrija, a mine which has been exploited for many centuries; asbestos found in large quantities with the mines of Kopacnik perhaps best known. Magnesite mining increased greatly in the post war period and Yugoslavia together

TABLE III

YUGOSLAVIA: RESERVES AND PRODUCTION OF MAJOR COAL BASINS, 1953

Location			Type of coal	Estimated reserves (quantity in mill. metric tons)	Year of estimate	1953 output in 100 metric tons
Area	Name of mines	Republic				
Istrian (Rasa)	Rasa, Podlabin, Potpican	Croatia	Bituminous	28	1950	683
Central Bosnian	Zenica, Kakanj, Breza	Bosnia and Herzegovina	Brown	800	1951	1,290
Sava Basin	Zagorje, Trbovlje, Hrastnik, Lasko, Senovo	Slovenia	Brown	270	1945	*
Banovici	Banovici	Bosnia and Herzegovina	Brown	300	1953	985
Senj-Despotovac	Senj, Resava, Ravna, Reka, Morava	Serbia	Brown	310	1951	*
Aleksinac	Aleksinac	Serbia	Brown	28	1951	*
Kreka	Kreka, Bukinje, Puracic, Lukavac, Dobrnja	Bosnia and Herzegovina	Lignite	4,000	1953	1,215
Kosovo	Kosovo	Serbia	Lignite	8,000	1953	659
Kolubara	Kolubara, Junkovac, Prokosava, Radljevo, Zvizdar	Serbia	Lignite	2,100	1953	381
Kostolac	Stari Kostolac, Novi Kostolac, Klenovnik	Serbia	Lignite	1,100	1952	*
Velenje	Velenje	Slovenia	Lignite	500	1953	528

*Figures not available.
Source: Mid-European Studies Center, 1954. Official Yugoslavian Statistics.

with Austria are the two largest producers in Europe. Graphite is mined especially in Slavonia, gypsum in western Macedonia, and important deposits of rock salt are found near Tuzla in Bosnia. Deposits of nickle, cobalt, and wolfram are known but commercial production has not been reported.

There are sizable deposits of fine chalky marl near Split and in Istria, very important for the manufacture of cement, which is one of the oldest industries of Croatia. Raw materials necessary for construction are widely distributed in the country with clay for brickmaking in the Pannonian plains and marble quarried in Istria, in the island of Brac at Pletvar, and in Venoac in Serbia.

Power[16]

The distribution of hydro-electric power plants at the beginning of the Five Year Plan was most uneven, with 70 per cent of the plants located in Slovenia producing 39 per cent of the power; only 7 per cent of the stations were located in Dalmatia but these produced 47 per cent of the energy. Due to the mountainous character of the country, large unused water reserves are available. Only 3 per cent of the hydro potential has been tapped. Rainfall is most advantageously distributed. In the Alps and the Dinaric Mountains

[16] Milic Zivko: "The Symphony of Light," *Yugoslavia*, Winter, 1950, pp. 49–56; and Guenzel, Industrielle Produktion in Markert, Jugoslawien, *op. cit.*, pp. 260–263.

TABLE IV

YUGOSLAVIA: RAW MATERIAL PRODUCTION

(In 1,000's)

Raw Material	*Unit*	*1939*	*1946*	*1954*
Antimony Ore	Tons	18.9	30.5	75.2
Bauxite	Tons	718.7	70.6	680.6
Chromium	Tons	44.9	77.1	124.5
Coal:				
Brown	Tons	4,312	3,823	7,100
Lignite	Tons	1,320	2,072	5,565
Bituminous	Tons	1,410	757	980
Copper Ore	Tons	984	646	1,299
Crude Oil	Tons	1.1	28.8	216.3
Lead and Zinc Ore	Tons	774.8	617.7	1,484.5
Magnesite Ore	Tons	5.7	7.5	9.2
Mercury	Tons	.4	.3	.5
Pyrite Ore	Tons	49.9	48.5	2.2
Electric Power:	KWH	1,173	1,150	3,440*
Hydro	.....	566	478	1,810
Thermal	.....	607	672	1,630

*65 per cent used by industries.
Source: *Indeks*, March, 1955.

TABLE V

YUGOSLAVIA: IRON ORE RESERVES AND TOTAL PRODUCTION, 1954

Name of basin	*Republic*	*Proven reserves in 1000 metric tons*
Vares	Bosnia	108
Ljubija	Bosnia	23
Sumadya	Serbia	6
Slepce-Tamyste	Bosnia	7.5
Rudna Glava	Serbia	0.5
Suvo Rodiste	Serbia	0.5
Proven Reserves	.....	145.5 mill. metric tons

1954 Production: 1,110,743 metric tons.
Source: Official Yugoslavian Statistics, estimate by Mid-European Studies Center, 1954.

the maximum precipitation occurs in the spring and fall as well as the beginning of winter. Southern Serbia and Macedonia has dry summers, but snow in the higher regions supplies the rivers with abundant water during the early part of the dry season.

Karst topography with rainfall seeping down and creating underground rivers constitutes a great hydro-electric potential. Rivers flow through canyons and their waters cause accumulations of limestone in step-like formation, such as those in the Cetina, Krka, and Neretva Rivers in Dalmatia and Bosnia (Fig. 3), the Korana at the Plitvica Lakes in Croatia, and the Pliva near Jajce in Bosnia which create waterfalls all of which will ultimately be utilized for the construction of hydro-power plants. Construction is now under way in Jajce and near Sibenik on the Adriatic Sea.

Plans are also under way to tunnel the waters from the high to the low karst areas, using the fall for further power potential. Reclamation work would go hand in hand with these developments. The completed plants in Vinodol, Croatia, and Jablanica, Bosnia, are the first of these kind. Plants are also under construction utilizing some of the lowlands and lakes in Serbia and Macedonia (Vlasina above the Morava and near Mavrovo) where water can easily be stored. The developments on the Drava River—ultimately

FIG. 3. Neretva River, Bosnia, South of Jablanica. View toward north on road from Sarajevo to Mostar. Karst topography.

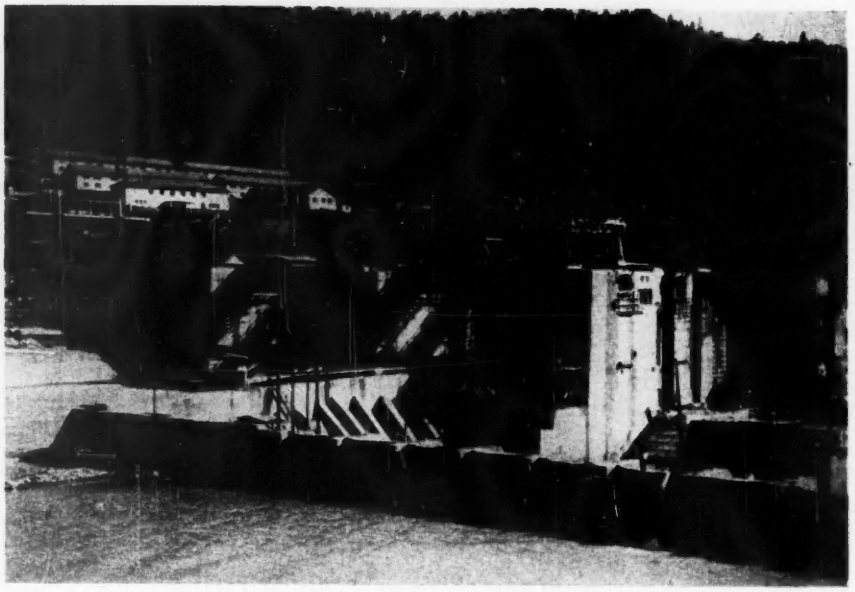


FIG. 4. Drava Dam with power station under construction near Vuzenica, Slovenia. This is one of six dams under construction or planned between Dravograd and Maribor, a distance of about 50 km. View from highway Dravograd to Maribor toward southwest.

seven hydro-electric stations between Dravograd and Maribor alone (Fig. 4)— the Sava River, a new plant on the Kupa River, the proposed multi-purpose plants at the Tisa and Danube, and many others will not only supply Yugoslavia with all the power needed, but will provide a considerable amount for export. Only recently discussions were held in the United Nations with a view toward interesting foreign investors in helping finance some of the larger hydro-electric power projects contemplated. When completed these plants will export considerable power to neighboring countries, especially Italy.[17]

The large deposits of brown coal and lignite will also contribute to the thermal power plants which are planned or have been completed already. Thermal power production has increased 2.5 times since 1939 and hydro power increased more than 3.5 times since 1939. The hydro-electric plants planned and completed will form the basic power supply and the thermal production will largely serve as an addition to the existing needs and emergency purposes. In addition to the building of power stations, an enlarged transmission network, closer connection between the network of the hydro-electric and thermal plants, and the work of connecting the Yugoslavian grid with that of the neighboring countries is urgently needed.

[17] A provisional report on the prospects of exporting electric power from Yugoslavia was compiled by the Economic Commission for Europe, Committee on Electric Power, EP/65, May 10, 1954. The final report "Yougelexport" was released in March 1955 and experts from four countries came to the conclusion that considerable water reserves are available in Yugoslavia, much of which would be available for export, and recommended the organization of an international committee to finance the building of five hydroelectric plants: ECE, Committee on Electric Power, EP/65, "Report to the Committee on Electric Power by the Group of Experts on the Prospects of Exporting Electric Power from Yugoslavia," May 10, 1955.

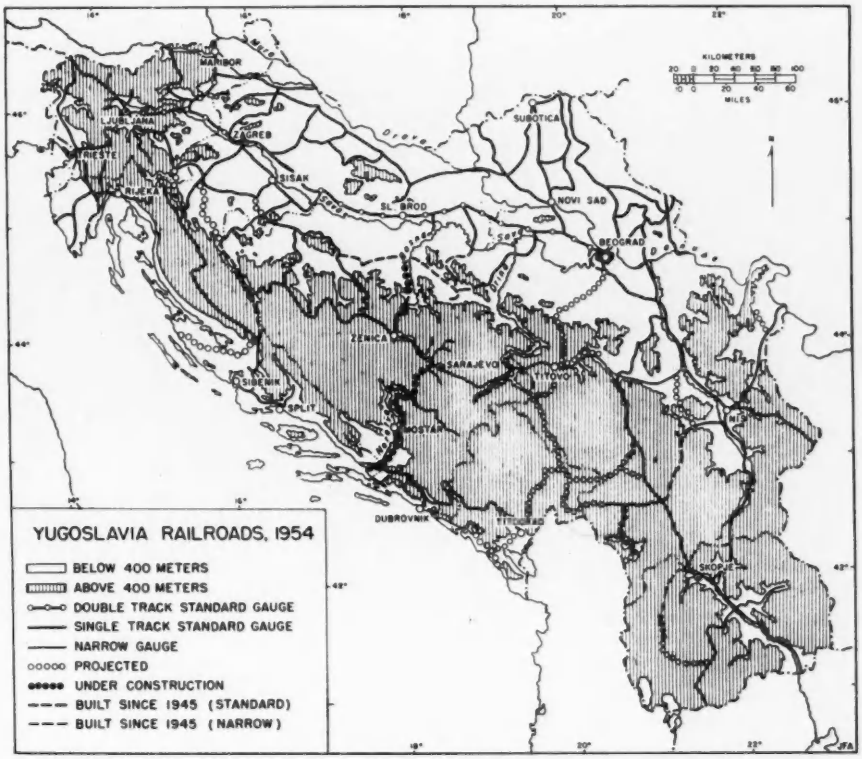


FIG. 5. Yugoslavia railroads, 1954. (Source: Markert (ed) Osteuropa-Handbuch: Jugoslawien, 1954, Karte X.)

Transportation[18]

The basic problem of transportation in Yugoslavia is historical. Slovenia, large parts of Croatia, and the Vojvodina for centuries formed part of the eastern military boundary of the Austria-Hungarian Empire. They had excellent inter-connections with each other as well as with the core of the Empire, the Pannonian Basin. The transportation pattern today in this area is still sufficient, even though modernization, for example double tracking of rail lines, is urgently needed. But the connection of these northern areas with the rest of Yugoslavia is wholly insufficient and was never solved during the two World Wars. In addition, the low transportation density of the rest of the country is in itself a great handicap to the economic development of the country.

Fundamentally, then, the problem is an inter-connection between three physiographic and economically diverse regions: the northern lowlands, the mountainous core, and the Adriatic coastal fringe. There is great need for horizontal lines of communication. This is especially important since the main contributions of these regions—food

[18] For a detailed discussion of the transportation problem see Walter Hildebrandt, "Verkehrssystem und Landesausbau," in Markert, Jugoslawien, *op. cit.*, pp. 287–299.

production, heavy industries, mining and foreign trade—are essential to the country's economy.

The new state of Yugoslavia has proceeded very methodically in attacking this problem. The task is not easy because the natural conditions are not at all favorable for the building or modernization of railroads or highways through the mountains which rise directly from the Adriatic coast. Changing the gauge of the country's railroads, connecting them with the main northwest-southeast lines, adding new lines largely to transport raw materials from the mines to the industries, modernization of existing lines, the building of a series of horizontal standard gauge railroads, and the completion of lines connecting two or more important regions, begun long ago, are the main tasks in planning to accomplish an adequate transportation system.

From 1946 to the end of 1954 the total trackage has been increased by more than 10 per cent. Added to this should be approximately 1000 km, which were changed from narrow to normal gauge. Among the most important lines already completed or nearing completion are the following: (1) Bosnia Samac to Sarajevo (Bosnia Railroad 242 km) serving the important central Bosnian industrial areas and connecting them with the main northwest-southeast network. (2) Bihac to Knin, connecting it with the Knin-Split and Split-Rijeka-Zagreb line. The line from Bihac to Karlovac and Bihac-Zara is in the planning stage. This should open up the important parts of the Dinaric Mountains and give the ports of Zara, Sibenik, and Split a fast connection with the northern part of the country and with Zagreb. (3) In the planning stage is the change from narrow to normal gauge railroad from Sarajevo to the Adriatic at Kardeljevo. This line, when completed, will be an important horizontal line, but due to tremendous building difficulties it will be only a single track railroad. Ultimately, this line will be electric, receiving its current from the new hydro-power station at Jablanica. It will connect with the important narrow-gauge line to Dubrovnik and later to the new capital of Montenegro, Titograd. (4) Another horizontal line will be the new Adriatic Magistrale from Beograd to Bar, the new port under construction south of Titograd. This line is a difficult engineering feat and will open up one of the most dissected, but minerally rich, regions of the Dinaric mountains and, with the exception of the northern end and the area in the south around Titograd, must run throughout territory which has an extremely low population density. Plans for this railroad were first made in 1920, but the tremendous costs and low economic returns never made this project feasible. It is estimated that the completion date now will be approximately 1960.

One of the most important additions to the rail network is the new NW-SE rail line from Banja Luka to Tuzla (completed) and Tuzla via Zvornik to Sabac which is only partially completed. When this line is completed a second NW-SE rail line south of the Sava River will be available. This will be of great economic and also of strategic importance.

Many other short lines have already been added or their trackage widened and plans for a great many additions are in the advanced planning stage. Among the short but important connecting lines completed, mention should be made of the lines between Pula and Rijeka in Istria and those connecting various parts of the newly acquired territory in Istria with the industrial hinterland in the Ljubljana Basin.

TABLE VI

YUGOSLAVIA: MOVEMENTS OF RAW MATERIALS TO STEEL PLANTS, 1954*

(All distances in Kilometers)

Location of steel plant	*Coal*			*Iron ore*	*Coke*
	Bituminous	*Lignite*	*Brown*		
JESENICE, Slovenia	Rasa, 320	Velenje, 190	Trbovlje, 117	Ljubija, 370 Vares, 683	Lukavac, 560 also imports
RAVNE, Slovenia	Rasa, 374 also imports	Velenje, 43	Trbovlje, 118	Ljubija, 390	Lukavac, 540 also imports
SIBENIK, Croatia	Rasa, 340 (by sea)			Ljubija, 301	Imports by sea
SISAK, Croatia	Rasa, 390	Velenje, 190	Trbovlje, 140	Ljubija, 110 Vares, 460	Lukavac, 330 also imports
SMEDEREVO, Serbia	Rasa, 840			Pig iron by river from Sisak or rail and river from Zenica	Lukavac, 340 also imports
STORE, Slovenia	Rasa, 288 also imports	Velenje, 43	Trbovlje, 42	Ljubija, 340 Vares, 650	Lukavac, 465 also imports
ZENICA, Bosnia	Rasa, 750 also imports	Within radius of 150 km	Within radius of 100 km	Vares, 80 Ljubija, 250	From nearby mines, some imports

*Information for this table based on figures of summer 1954.
Most of the above distances will undergo a reduction as soon as the Banja Luka–Sabac railroad is in operation.
Source: Official Railroad Timetable 1952/53
Official Yugoslavian Statistics
Ivan Avsenek: *The Iron and Steel Industry in Yugoslavia 1939–1953*, Mid-European Studies Center, New York, April 19, 1953.

Work is progressing and plans have been made to increase and add to the transportation pattern in nearly every part of the country, including the modernizations in the Slavonian-Vovjodina lowlands. This includes also a series of modern highways, such as the road from Zagreb to Beograd completed in 1952 and a modern highway from Rijeka to Zagreb now nearing completion. The widening of roads in the Dinaric Mountains is a real technological problem and is progressing slowly.

Special attention has been given to the navigability of rivers. The Tisa and Danube Rivers are the only two rivers which are navigable. Other rivers, such as the Drava to Barc and the Sava to Sisak, are navigable for short distances. Future plans include the navigability of the Sava to Zagreb, the building of navigable canals, and numerous other additions.[19]

As can be seen from Table VI showing the distance between the steel producing plants and the source of raw materials, transportation, at the moment, is the bottleneck for the efficient and low-cost operation of industries. With increasing overseas trade, the most efficient connections between the producing areas and the ports become a matter of urgent economic necessity. It will be a long time before many of the railroad lines show an economic return, or the highways and rivers show

[19] Hildebrandt, Verkehrssystem in Markert, *op. cit.*, p. 296. A possible Zagreb-Ljubljana waterway is evidently impossible according to Cene Malovrh: "Ekonomsko-geografska skica pogojev za plovno zvezo Zagreb-Ljubljana (An economic-geographic sketch of the proposed waterway Zagreb-Ljubljana)," *Geografski Vestnik*, Vol. 25, 1953, pp. 45–58.

heavy traffic, but the improvements in the transportation pattern are essential to the economic development of the country.

Manpower

Before World War II, Yugoslavia had made slow progress in its attempt to industrialize and the density of the agricultural population had even increased. More than three-fourths of the active population were still engaged in agriculture, forestry, and fishing.[20] The vital problem of overpopulation and raising the standard of living among the people, especially the subsistence economy of the backward regions, had not been solved.

TABLE VII

PRODUCTION OF THE STEEL INDUSTRY

(In 1,000 metric tons)

Item	*1939*	*1946*	*1954*
Pig Iron	101	84	356
Crude Steel	235	202	616*
Rolled Products	151	112	411
Seamless pipes	...	.....	16
Rails and Accessories	...	2.7	47.6

*Production was distributed approximately as follows: 55% in Bosnia and Herzegovina, 37% in Slovenia, and 8% in Serbia.

Source: *Indeks*, March, 1955.
Economic Survey of Europe in 1953, United Nations Department of Economic Affairs, Geneva, 1954.

With industrialization of the country playing such an important role since 1945, the large manpower supply[21] has become one of the vital resources of Yugoslavia.

On the other hand there is considerable deficiency in manpower in the most productive groups of the country's population, the ages 25 to 49 years. Two wars within one generation have greatly affected the demographic structure of the country. The number of persons capable of working is smaller in Yugoslavia than in many other European countries, e.g., averaging only 61.9 per cent as against 66.6 per cent in Western Germany or 65 per cent in Austria. At the present time the number of people capable of working is roughly 10.5 million, but it is estimated that this figure will increase to 13 million by 1975 due to the large percentage of people under 15 years of age at the present time.

The high potential labor force is the result of a high birth rate and labor released from agriculture. The latter is expected to rise steadily with increased mechanization and will present a real problem to the government which must plan on a steadily increasing domestic and foreign economy to provide an adequate number of jobs. The young people of Yugoslavia will, to a large degree, measure the success of their socialist society in terms of job opportunities and sufficient income to enable them to lay the foundation for a satisfactory life.

Another problem brought about by the rapid industrialization in the country is the shortage of trained personnel—engineers, foremen, and key workers.[22] The uneven regional employment situation and certain basic social problems, e.g., the absence of a "stimulus given by the sight of higher standards of

[20] According to Economic Survey of Europe, *op. cit.*, p. 109, their average income was about one-third of the average income of the other one-fourth active population.

[21] Paul F. Meyer and Arthur A. Campbell: *The Population of Yugoslavia*, International Population Statistics Reports, Series P–90, No. 5, Bureau of the Census, U.S. Department of Commerce, Washington, D. C., U.S. Government Printing Office, 1954, pp. 16–27, pp. 70–87; Ipsen, Wachstum und Gliederung der Bevoelkerung in Markert, Jugoslawien, *op. cit.*, pp. 41–58 and Ranko M. Brashich: *Land Reform and Ownership in Yugoslavia* 1919–1953, New York, *Mid-European Studies Center, Free Europe Committee, Inc., 1954*, p. 169.

[22] Universities, teacher training schools, and technical schools now have been established in every Republic. Workers receive leave to attend schools, and evening courses (extension service) have reached many communities.

living" make progress slow.[23] The Government gives special attention to the reduction of the illiteracy rate, which at the present time is still estimated at 24 per cent of the population even though in its regional distribution it is confined largely to the Federal Republics of Bosnia-Hercegovina, Montenegro, and Macedonia.

Trained workers, foremen, and engineers have been shifted to new industrial projects. This generally has meant sending the more technically advanced Slovenes and Croats to the more backward regions where a concentration of new industrial projects has proceeded. These population movements and intermixtures may very well have considerable effect on the age-old distribution of nationalities and may ultimately bring a reduction in the nationalistic feelings of individual language and religion groups and result in a greater unity of the Yugoslavian State.[24]

INDUSTRIES

Generally speaking industrial production in 1954 was more than double that of 1939. It had completely recovered from wartime devastations and many of the new key projects are nearing completion or have already been completed. The new industries were built to tap the country's rich natural resources which have been neglected so long. Existing industries have been modernized—many with United States, British, and French financial aid—and numerous new ones have been added. Investments in heavy industries have received top priorities, but a good beginning also has been made, e.g., in the manufacture of machine tools, in making optical instruments, and in many other light industries. The Government is hoping that modest demands for consumer goods can soon be supplied from domestic production.

One of the important aspects in the industrial distribution of Yugoslavia is the great structural differences within the country. Slovenian industries consist largely of industries employing 30–1000 workers—74.4 per cent of all industries, and 61 per cent of all workers—while in Bosnia only 59 per cent of all industries, employing only 37 per cent of the workers, fall in this group. Of those employed in industries 61 per cent found work in the 13 heavy industries employing over 1000 workers. Between these two extremes is the situation of Croatia and Serbia, while the industrial development of Macedonia and Montenegro is still in its infancy and largely confined to mining. It is clear that not until a large number of industries employing less than 1000 workers and distributed more evenly throughout the countryside has been found will it be possible to absorb a larger number of surplus workers, or give the people a better safeguard against unemployment. Light industries (including consumer industries) which employ fewer people per establishment, but are more widely distributed, form the core of any industrial state. But priorities of the last ten years have been given to heavy industries, and these naturally can be located at only a few places.

It has been the aim of Yugoslav planners to locate these heavy industries close to the sources of the main raw materials, but this has not always been possible. Of all the Republics, Bosnia, Macedonia, and Montenegro received the largest number of new industrial

[23] Economic Survey of Europe, *op. cit.*, p. 121; also, H. R. Wilkinson: "Jugoslav Macedonia in Transition," *Geogr. Journ.*, Vol. 118, 1952, pp. 399–401.

[24] Fred Warner Neal: "From Particularism to Unity," *American Universities Field Staff*, FWN-6054, pp. 9–13.

enterprises. Abundance of a great variety of raw materials, including unused power reserves and surplus manpower, makes this a natural choice.[25] As a result, raw materials and finished goods, especially those being exported, must be shipped long distances. This, naturally, often makes production highly uneconomical. The Government hopes to reduce those distances with the new rail lines, highways, and waterways now under construction.

During the past years three problems have constantly plagued industrial production: shortage of skilled labor, shortage of raw materials, and shortage of power. The solution of these problems has been brought closer during the last year and it is hoped that, with additional technical schools, an increased raw material output, modernization of mines, additional power plant and transmission lines, and better long term planning, industrial production will no longer be interrupted by these bottlenecks.

The Distribution

From our earlier pages of this paper it can be seen that a good basis for heavy industry exists. Iron ore, mostly in Bosnia and Hercegovina; considerable brown coal and lignite with a number of newly erected coking plants; and an abundant supply of secondary ores, e.g., manganese, chromium, and molybdenum used in the iron and steel industries—are available. The largest and most modern steel producing plants are found in Bosnia in the region of Zenica. A total of 11 open hearth and several Bessemer converters will give this region a raw steel capacity of close to 450,000 tons. Several rolling mills (one installed by Krupp in 1937), a blooming mill from the United States, an oxygen plant, nail-works, gas generator, power plants, and other closely related plants are already making the Zenica the largest iron and steel combine in Yugoslavia.[26]

The second most important steel industry is that of Slovenia which is centered around the old works of Jesenice, Ravne, and Store. The Jesenice works produce the largest number of types of steel and also consists of a series of plants (Fig. 7). The Ravne works close to the Austrian border specializes in high-grade steels. Their products are exported all over the world. The facilities at Store have been enlarged since the war, and among them is a plant for the production of fire-proof material.

The combine in Sisak, located only 40 miles from the important iron ore mines of Ljubija and at the end of the navigable portion of the Sava and Kupa Rivers (Fig. 6), is one of the most modern steel plants in the country. German and Italian reparations and a loan from the "International Bank of Reconstruction and Development" have contributed to the equipping of a seamless steel pipe division. Sisak, Jesenice, and Zenica are considered the best equipped and largest metallurgical plants in the country.

A new electro-steel mill was built in Sibenik in 1947, using power from a new hydro-electric station. An older metallurgical plant in Smederevo on the Danube has recently erected an open hearth furnace, a blast furnace, and a rolling mill. Emphasis here is on production of rolled goods. Table VII shows an increase in the production of crude steel from 235,000 metric tons in 1939 to 616,000 in 1954. With additional mod-

[25] Avdo Homo: "Economic Prospects—Bosnia-Hercegovina," *Yugoslavia*, Vol. 7, 1953, pp. 26–29.

[26] Ivan Avsenek: "The Iron and Steel Industry in Yugoslavia 1939–1953," *Mimeographed Series, Mid-European Studies Center* No. 25, April 19, 1953, p. 14; also Karl Guenzel: "Die Industrielle Produktion," in Markert, Jugoslawien, *op. cit.*, pp. 263–265.

FIG. 6 (upper). Kupa River near Sisak. Oil barges on river with old Turkish castle in background. The Kupa River is navigable to Sisak and important for river traffic to the newly built steel mills. Raw materials can be shipped on the Danube and the Sava to the Kupa. View toward north from road Sisak to Caprag (location of steel mills).

FIG. 7 (lower). Steel mills in Jesenice, Slovenia. View toward north from road Jesenice to Bled. Javornik division of Jesenice steel mills in center, slopes of Karawanken Mountains in background. Rolling plant toward left.

ern equipment it is hoped that production will be increased to over one million tons by 1960.

Among the many other industries erected or modernized and enlarged are the numerous smelters located at the mines, and a series of light industries (Table VIII), e.g., the aluminum plant in Sibenik which contributed to the doubling of the output since 1939, the chemical industries with production in pharmaceutical articles, various acids, fertilizer, glass, paints, etc. Mention should also be made of the textile industries, including the newly developed silk industry in Macedonia and the leather industry with the largest number of plants in Slovenia. Also, plants producing machine tools, agricultural machinery, oil drilling equipment, the bridge building industry, railroad equipment, a small truck industry, transformers and ventilators, a locomotive factory, and many others. Important contributions come from the electro industries which are already able to supply a large part of the domestic market, thanks to the abundance of copper and lead. The wood-processing industry, utilizing the rich oak woods along the Sava and Drava, the pines and firs of the Alps, and the Mediterranean type forests play an important role.

Many important industries are now represented in Yugoslavia, and while the original plans often were too ambiguous the adjustments since 1948 and the greater initiative of the individual Republics have contributed to the increased industrialization of the country.[27]

PROBLEMS AND PROSPECTS

What are the problems and prospects of industrialization in Yugoslavia? Basically they can all be traced to certain geographic facts. These can be briefly summarized as follows: (1) the division of the country into three basically different regions—the fertile hill lands, basins, and in-between lands, the mountainous core, and the cities and ports along the Adriatic;[28] (2) the fertile areas of Croatia and Serbia supplying more than two-thirds of the grain needs of the country; (3) the backwardness of agricultural methods of the most fertile regions, lack of incentive and machinery with resultant low crop yields per hectare, and recurrent droughts in these areas and their disastrous results to the whole economy; (4) the regional geographic differences and their cultural implications—the more advanced cultural level of the people of Slovenia, Croatia, and parts of Serbia, and the backwardness of the people in the Dinaric Ranges and Macedonia; (5) the high birth rate of the peasant population and the need for employment opportunities for the resulting large surplus population; (6) the large reserves of important raw materials in the mountainous parts of the country and, as a result, new industrial establishments in the interior valleys. This location raises problems of accessibility and high costs of production. Locating industrial establishments in certain backward, mountainous regions and not just removing the minerals may be good politics but not necessarily good economics.

The prospects of industrialization are naturally closely related to the overall economic development of the country. The most important step for the Yugoslav economy is the need for increasing

[27] On the other hand there has been an increased tendency by the Central Government to avoid duplication of industrial plants in individual Republics and regulate imports of important raw materials.

[28] B. A. Milojevic: "Les Hautes Montagnes de Yougoslavie et leur role de séparation et de liaison," *Institut de Géographie de Clermont-Ferrand*, 1953, pp. 113–118.

TABLE VIII

YUGOSLAVIA: SELECTED INDUSTRIAL PRODUCTION 1939–1954

Products	*Unit*	*1939*	*1946*	*1948*	*1954*
Building Materials					
Bricks	1000	379.68	323.67	722.26	743.16
Cement	1000 Tons	894	698	1,169	1,393
Chemical Industry					
Sulphuric Acid	Tons	23,233	29,320	43,630	59,950
Caustic Soda	Tons	13,673	5,958	18,560	23,392
Calcium Carbide	Tons	54,920	17,671	41,059	39,734
Copper Sulphate	Tons	12,833	12,498	20,318	13,080
Fertilizers	Tons	72,770	46,864	79,631	120,605
Electric Industry					
Rotating Machines	KW	4,300	8,400	79,817	230,564
High Voltage Bulbs	1000	2,522	1,622	4,348	5,867
Transformers	KVA	29	3,791	77,227	557,352
Non-Ferrous Metals					
Aluminum in Blocks	Tons	1,795	567	1,884	3,496
Blister Copper	Tons	41,643	21,730	36,870	30,295
Electrolytic Copper	Tons	12,463	12,925	14,441	26,946
Refined Lead	Tons	10,651	32,591	49,214	66,729
Silver	Tons	1,303	8,679	46,787	88,004
Non-Metal					
Flat Glass	1000 m²	1,678	1,734	2,470	5,025
Blown Glass	Tons	10,927	11,986	17,157	21,472
Asbestos Fibre	Tons	.....	.....	749	3,264
Electro-Porcelain	Tons	188	161	492	1,332
Rubber					
Footwear	Tons	5,154	2,310	5,386	8,254
Tires for Motorcars	1000	8	4	35	76
Tires for Bicycles	1000	276	169	580	490
Textiles					
Fabrics:	1000 m²	.....	.....	.....	.....
Cotton	.....	110,617	89,405	160,606	165,586
Woolens	.....	12,443	16,010	28,686	19,771
Hemp	.....	6,685	3,201	4,044	6,743
Artificial Silk	.....	14,012	1,335	10,289	8,522
Yarn:	Tons	.....	.....	.....	.....
Cotton	.....	18,947	23,670	27,776	34,102
Wool	.....	6,216	8,907	13,032	8,717
Timber and Paper					
Sawn Timber	1000 m³	1,922	1,202	2,770	1,881
Wallboards	1000 m²	21,000	10,500	27,000	45,000
Mechanical Wood Pulp	Tons	9,853	8,558	16,701	19,634
Cellulose	Tons	28,324	12,496	22,134	43,546
Paper and Cardboard	Tons	42,438	43,584	56,810	58,474
Tobacco					
Fermented	Tons	16,525	7,046	31,932	30,475
Manufactured	Tons	11,771	9,638	14,919	15,599

Source: Compiled from Indeks, 1955.

agricultural production which will permit a satisfactory supply for the growing home market and increased exports. Increased agricultural exports will mean a considerable improvement in the trade balance with sufficient foreign exchanges available which in turn will permit a more steady flow of raw materials and finished products with resultant additional and more steady employment opportunities. Increased agricultural production is, then, essential to the industrialization of the Yugoslavian agrarian society, but this can be accomplished only by a complete overhauling of the agricultural section, e.g., added incentives to the peasants, increasing yields, wide-scale mechanization, production of a wider range of goods, improvement of livestock, etc.[29]

[29] There is reason to believe that the Federal Government at the end of 1955 is giving more

(*Continued on next page*)

The original plans for industrialization—doubling of the productive capacity of 1939 by 1951—had to be spread out over a longer period and some projects had to be abandoned altogether. This was largely due to the break with the Soviet Union and the resultant cessation of trade between the Soviet Union, the Satellite countries, and Yugoslavia; to the considerable expenditures for military defense; and to three droughts in the last six years. In spite of these difficulties many new plants have been brought into operation and production generally has increased. This has been accomplished by plowing most of the industrial profits back into industries (largely heavy), often to the detriment of needed expansion in other sections of the economy.

Those planning Yugoslavia's future gave top priority to the establishment of heavy industries.[30] It was their plan to produce as many key products within their country and in as short a time as was possible. The distribution of these new industries, as pointed out earlier, was limited to a few key places. But if industrialization is really to benefit a large part of the population and give employment to the surplus labor it is essential to build numerous small and medium-sized industries with an employment of between 30 and 500 and to distribute these plants as widely as possible among the mountainous valleys and the coastal and interior plains. Also, the introduction of a greater diversity in industrial production, both in light and consumer goods, should offer greater employment possibilities and by increasing wages and holding prices down the buying power of an ever-increasing portion of the population could materially be increased. This will be of vital importance when key industrial projects are completed a few years hence, and attention must be given to consumer industries and marketing of all those industrial products. An increase in the productivity of the workers and a reduction of the high transportation costs will lower production costs and this in turn will materially contribute toward the opening of additional markets, both domestic and foreign. With relations between Yugoslavia and its eastern neighbors and the USSR again greatly improved, newly opening trade channels should greatly benefit the economy of the country.[31]

Regardless of the many new ideological facts of the Yugoslavian state, establishment of a workers' society with rapid industrialization in a state where more than two-thirds of the population are still dependent upon agriculture for their livelihood, raises many difficult questions. Even though early plans for locating new or enlarging old industries have remained relatively unchanged since the introduction of the original Five Year Plan in 1946, the country's economy is still in transition and experiments with different economic practices are under way. With low productivity and the small income of a large majority of the population still predominant, with prices of consumer goods high and the income of the farmer extremely low, important problems for the country's future economic development become

serious attention to improving the lot of the farmers. Increased investments in farm machinery, talk of establishing an agricultural bank, and other measures are indications of this change.

[30] Harry Pross: "Zehn Jahre Tito-Regime: Ideologie und Staatsraison," *Ost-Probleme*, Vol. 7, 1955, pp. 466–478.

[31] By the end of 1955, trade agreements either have been concluded or are in the process of being concluded with all countries of East Central Europe. In the recently concluded trade treaty with the USSR, Yugoslavia received an outright loan of over 30 million dollars with 2 per cent interest and a $90 million debt incurred before 1948 was cancelled. Still, Yugoslavia owes more than $400 million in debts, of which $300 million are in short-term obligations to different countries.

self-evident. Prospects of solving these vital problems depend on the priorities established by the Yugoslavian government and to a lesser degree on external political developments.

The geographic location of Yugoslavia, its rich resources, and its great cultural diversity are, at the same time, elements of strength and of weakness.

ACKNOWLEDGMENTS

Appreciation is extended to colleagues in Yugoslavia and to Dr. Fred W. Neal of the University of Colorado and American Universities Field Staff for their assistance and comments. Field work was made possible by a grant received from the Social Science Research Council and The Fund for the Advancement of Education (Ford Foundation). Aid is also acknowledged from the Graduate Research Institute of the University of Texas.

REFUGEE INDUSTRIES IN WEST GERMANY AFTER 1945*

Colbert C. Held

Dr. Held, Associate Professor of Geography at the University of Nebraska, has had several seasons of field work in Europe and collected the information for this study while teaching in the University of Maryland European Program.

As a result of the defeat of Nazi Germany and the *de facto* dismemberment of the Third Reich, more than 12 million Germans were forced to seek refuge in the four zones of occupied Germany after May, 1945. The fugitives were of two types, according to their former nationality: First and most numerous were the Reichsdeutsche, who were expelled from territories of 1937 Germany taken over by Poland and the Soviet Union and, to a small extent, also from the Saar; second were the Volksdeutsche, who were likewise expelled, although from other European areas that were not part of 1937 Germany but that had been settled by Germans some time in the past. Of these 12 million expellees, 8.3 million came directly or indirectly into West Germany; and, in addition, 1.9 million persons voluntarily fled the Soviet Zone of Occupation and became refugees in West Germany.[1] The term "refugees" has become the general term for both the "expellees" (*Vertriebenen*) and the "refugees" (*Zugewanderten*), although "fugitives" would perhaps be a more exact equivalent of the German word (*Flüchtlinge*) that is applied to both groups. In this paper, the terms "refugee" and "fugitive" are used interchangeably, unless the restricted meaning of "refugee" is specifically shown to be intended.

*This study was aided by grants from the Research Council of the University of Nebraska.

[1] *Statistisches Jahrbuch für die Bundesrepublik Deutschland, 1953*; Statistisches Bundesamt, Wiesbaden, 1953; p. 50. This unprecedented migration and many problems connected with it have been exhaustively studied by the Federal German government and by numerous independent scholars. See one excellent article on the subject published in this journal: Chauncy D. Harris and Gabriele Wülker, "The Refugee Problem of Germany"; Vol. 29, 1953, pp. 10–25. Harris and Wülker touch on the subject of refugee industry on p. 22.

Economic Impact of Fugitives

More than 10 million fugitives added to the 40 million inhabitants of the area that has come to be the German Federal Republic produced a 25 per cent increase in population. Such an increase would be equivalent to dumping 40 million homeless and, in most cases, destitute people into the United States with its 160 million people. Staggering enough in its simple numerical terms, the proposition becomes even more meaningful when it is recalled that the fugitives came into a defeated, largely destroyed, and enemy-occupied country that was itself nearly destitute. Nevertheless, even into a disintegrated economy, the newcomers had to be absorbed—not temporarily nor with short term charity, but permanently and with security.

Despite the obvious burden that the migrants constituted, they constituted other more important elements: mass skill, a stimulus, and a challenge. Most of the expellees and refugees were determined to work their way back to their former plane of living and were desperate for a chance to do so. Many

of them were skilled artisans, as a result of the traditional training procedures within the German guild organizations; others were able and experienced supervisors or managers; and a few were actual plant owners. As the postwar months passed, circumstances revealed a pressing need for many of the immigrants' skills. Contrariwise, the economic aggressiveness of many of the newcomers stimulated the West German expansion. Some of them found positions with established concerns; others started new enterprises, especially by joining efforts with fellow immigrants; and still others were able, with public or private assistance, to re-establish their own former businesses—the term to be understood in its broadest sense. It is with these refugee businesses that this paper is concerned.

In studying the fugitive nonagricultural economic enterprises, especially fugitive manufacturing industries, this paper has three general purposes: first, to describe the nature and extent of the migration of business enterprises into West Germany and to assess the significance of the migration; second, to shed some light from one angle on the remarkable recovery of West Germany in the post-war decade; and third, to examine locational factors in the siting of fugitive enterprises. Specifically, the paper attempts to answer such questions as these: How many fugitive enterprises are there in West Germany? How many of each type? How do they compare numerically with other new enterprises that have been established since 1945? How do they compare numerically with the total of all enterprises? Where did the fugitive enterprises come from? Where did they go in West Germany? When were they set up? Why did they leave their former sites? Why did they choose their present sites? What overall effect did they have on the West German industrial structure? How well will they survive?

It should be emphasized again that this paper takes no account of the thousands of agricultural enterprises initiated by the fugitives. No special account is taken of the thousands of completely new enterprises established by refugees, established by refugees jointly with indigenous persons, or established with all or part of the capital refugee-supplied. Such establishments are grouped with all other types of new enterprises that began operating after 1945. The nonagricultural refugee undertakings considered in this paper are defined as enterprises, formerly operated elsewhere than in West Germany, that migrated into West Germany between 1945 and 1950.

Fortunately, rather detailed figures on the subject were taken in the 1950 census by the West German Statistisches Bundesamt, but the office does not plan to consolidate and publish them in detail. The unpublished figures were, however, made available for the first time to the writer, who prepared all charts and maps in this study from raw data extracted from the files of the Statistisches Bundesamt. The classifications and nomenclature used here are necessitated by the procedures followed by the West German census bureau.

By the census time of September, 1950, a total of 85,127 fugitive business establishments of all types had been set up in West Germany. Since that time, an estimated 35,000 more have been initiated, but no details are available on the post-1950 establishments. As the bottom bar of the graph in Figure 1 shows, 31 per cent (690,460) of all business enterprises (2,266,261) in West Germany in 1950 were founded after 1945, and 3.75 per cent (85,127)

of all enterprises were moved in from outside West Germany. Thus, 12.5 per cent of the new enterprises were refugee enterprises. The two proportions, (1) fugitive businesses to all post-1945 businesses and (2) fugitive businesses to the total of all existing businesses, must be kept in mind in order to appreciate the scale and significance of the economic shift discussed in this paper (*cf.* Figs. 1, 2, 6, and 8). In assessing the impact of refugees on the nonagricultural economic structure of West Germany, it must also be made clear that probably more than half (no exact figures are available) of all business enterprises established in West Germany after 1945 were set up by refugees. However, the only enterprises included in the 85,127 figure are those that previously existed outside West Germany.

TYPES OF REFUGEE ENTERPRISES

In the first nine bars, Figure 1 shows graphically, for each of the nine Economic Divisions used by the Federal German Census, the percentage of all enterprises that were founded after 1945 (entire bar), with the black section at the beginning of each bar indicating the percentage of refugee industries. In the three vertical columns of figures, actual numbers within each Division are also given for (left to right) refugee business enterprises, all new enterprises, and all existing enterprises. Professional services (Division 9) has the highest percentage (6.3) of the total within any one Division, although—as the first vertical column of figures reveals—it does not furnish the greatest absolute number of fugitive enterprises. Then follow, in percental order, nonfarm plant and animal raising and small-scale fishing (Division 0, 4.7 per cent), although the absolute number of enterprises is small; nonmetal manufacturing (Division 3–4, 4.6 per cent), with the largest actual number of units; trade, finance, and insurance (Division 6, 3.4 per cent), with the second largest number of units—most of which are retail shops; and construction (Division 5, 3.3 per cent). The mining and quarrying Division (Division 1, 1.7 per cent) is low both percentally and numerically. Furthermore, in Division 1, the ratio of refugee enterprises to other new enterprises is the lowest (1: 13.6) of all the Divisions. Professional services (Division 9) is again highest in this connection (1: 4.5) and is followed by nonmetal manufacturing (Division 3 4 with 1 : 6.5), nonfarm plant and animal raising and small-scale fishing (Division 0 with 1 : 7.4), personal services (Division 7, with 1 : 9.7), and metal products manufacturing (Division 2, with 1 : 9.8).

The various ranks show logical developments in terms of economic opportunity and degree of difficulty of re-establishing divers enterprises. Obviously, one-man professional offices, retail stores, and repair shops are more easily transferred, especially into an unstable situation, than are more complex operations. Most of the fugitive undertakings are small and frequently involve only one owner-operator, although some of them employ hundreds of workers, as do a famous optical company, an office-machine factory, a hosiery mill, and numerous others. In considering the size of the refugee enterprises, it should be remembered, however, that in general the enterprises in the Sudetenland, in the easternmost parts of pre-1938 Germany, and in most of what is now the German Democratic Republic tended to be smaller than those in western Germany. Therefore, it is only natural that the refugee enterprises are relatively small in size.

One final point with regard to Figure 1 should be made. The number of refugee enterprises shown and their distribution

among the Economic Divisions are, of course, no reliable guides to the number and types of enterprises that the expellees and refugees left behind in their erstwhile homelands. In other words, during the process of moving 14 million people, hundreds of business enterprises simply disappeared. Many refugees who once operated independent enterprises had to become content, once they reached West Germany, as employees in someone else's business concern. This point is important in the evaluation of the loss suffered by both the expellees and expellers.

A more detailed picture of the "productive industries," with which this paper is more specifically concerned, can be seen in Figure 2. Here Economic *Divisions* 1, 2, and 3–4 of Figure 1 are broken down into 49 Economic *Groups*, again as determined by the German census. The bars in Figure 2 show graphically the actual number of refugee enterprises in each Group, whereas the number above each bar is the percental proportion of fugitive industries to *all* industries in the respective group.

Clothes-making (Group 43), mostly by single tailors and seamstresses, distinctly leads in the number of fugitive nonagricultural productive industries, with nearly 13,000 units. Leather and leather goods industries (Group 41) follow with nearly 5000. Both constitute a high percentage (7 and 5, respectively) of all enterprises within their two groups. Then in order follow wood products (38), with 2771 units; foods, beverages, and tobacco (45 through 49), with 2285 units; textiles (42), with 1473; precision and optical goods (28), with 1269; metalwares (29), with 1053; and vehicles (26), mostly

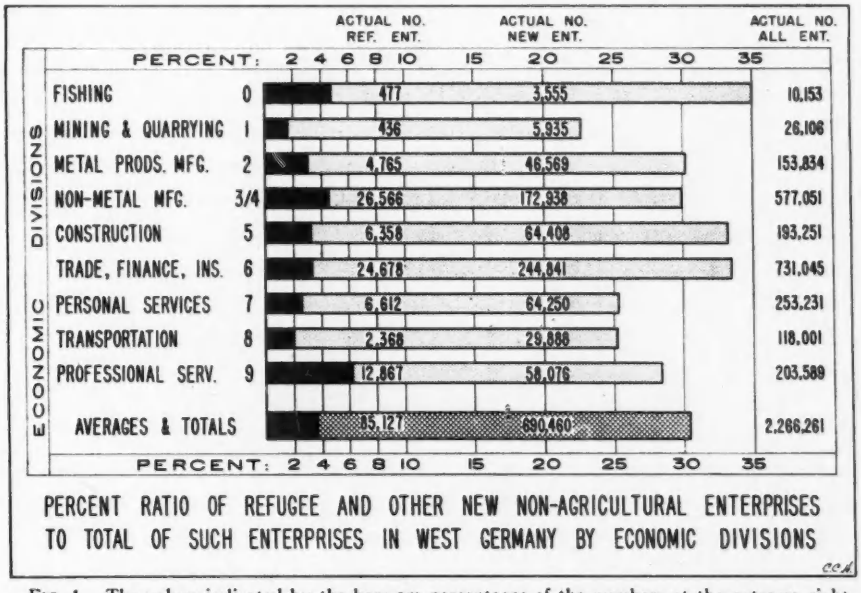

ACTUAL NO. REF. ENT.
ACTUAL NO. NEW ENT.
ACTUAL NO. ALL ENT.
PERCENT: 2 4 6 8 10 15 20 25 30 35
ECONOMIC DIVISIONS
FISHING 0 477 3,555 10,153
MINING & QUARRYING 1 436 5,935 26,106
METAL PRODS. MFG. 2 4,765 46,569 153,834
NON-METAL MFG. 3/4 26,566 172,938 577,051
CONSTRUCTION 5 6,358 64,408 193,251
TRADE, FINANCE, INS. 6 24,678 244,841 731,045
PERSONAL SERVICES 7 6,612 64,250 253,231
TRANSPORTATION 8 2,368 29,888 118,001
PROFESSIONAL SERV. 9 12,867 58,076 203,589
AVERAGES & TOTALS 85,127 690,460 2,266,261
PERCENT: 2 4 6 8 10 15 20 25 30 35
PERCENT RATIO OF REFUGEE AND OTHER NEW NON-AGRICULTURAL ENTERPRISES TO TOTAL OF SUCH ENTERPRISES IN WEST GERMANY BY ECONOMIC DIVISIONS
CCA

FIG. 1. The values indicated by the bars are percentages of the numbers at the extreme right. Black sections of the bars represent refugee enterprises, whereas the entire bars represent all enterprises founded in West Germany since 1945. Categories are those of the German census.

NOTE: Division 0 should properly be designated as "Nonagricultural horticultural and animal breeding and small-scale fishing," since it does *not* include regular commercial fishing.

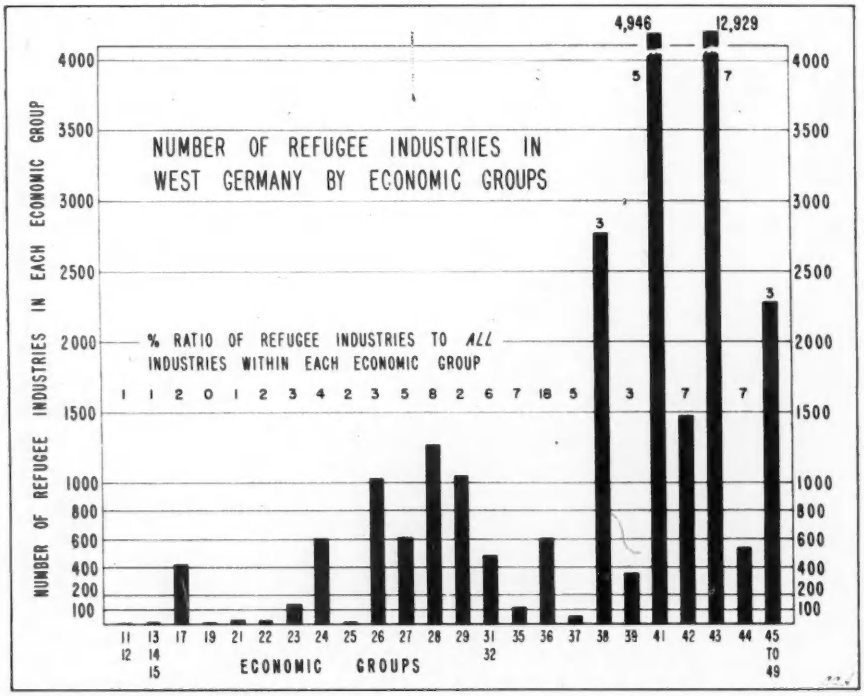

NUMBER OF REFUGEE INDUSTRIES IN WEST GERMANY BY ECONOMIC GROUPS
NUMBER OF REFUGEE INDUSTRIES IN EACH ECONOMIC GROUP
% RATIO OF REFUGEE INDUSTRIES TO ALL INDUSTRIES WITHIN EACH ECONOMIC GROUP
1 1 2 0 1 2 3 4 2 3 5 8 2 6 7 18 5 3 7 7
4,946
12,929
5
7
3
3
4000
3500
3000
2500
2000
1500
1000
800
600
400
200
100
11 12 13 14 15 17 19 21 22 23 24 25 26 27 28 29 31 32 35 36 37 38 39 41 42 43 44 45 TO 49
ECONOMIC GROUPS

FIG. 2. These Economic Groups include all mining and manufacturing industries and are subdivided from Economic Divisions 1, 2, and 3/4 in Figure 1. Bars represent actual numbers, but percentages are shown by numbers above the bars. Non-refugee new industry is not considered. The Economic Groups are:

11. Coal mining
12. Lignite mining
13. Ore mining
14. Crude salt production
15. Other mineral production
17. Quarrying
19. Energy production
21. Iron and steel
22. Nonferrous metals
23. Steel construction
24. Machinery
25. Shipbuilding
26. Vehicles and aircraft
27. Electrotechnical goods
28. Precision and optical goods
29. Metal wares
31. Petroleum refining and coal products
32. Chemicals
34. Synthetic goods
35. Rubber and asbestos goods
36. Ceramic and glass wares
37. Lumber and timber
38. Wood products
39. Paper and printing
41. Leather and leather goods
42. Textiles
43. Clothing
44. Musical instruments, toys, sporting goods, jewelry, gems
45–49. Food, beverages, tobacco

farm wagons, with 1034. Percentally high rank is shown by ceramics and glassware (Group 36), with a very high 18 per cent; precision and optical goods (28), with 8 per cent; and rubber and asbestos goods (35), textiles (42), clothing (43), and musical instruments, toys, jewelry, sporting goods, etc. (44), each with 7 per cent. Low numerical and percental rank are, logically enough, shown by coal and lignite mining (11 and 12), miscellaneous mining and quarrying (13 through 15), power generation (19), ferrous and nonferrous metal production (21 and 22), and shipbuilding (25). Thus, light manufacturing predominates among productive industries that migrated into West Germany. Industries requiring expensive and extensive installations would not be expected to be able to make the shift on a large scale. And, quite

naturally, fugitive mining concerns would be few, since they could not bring along with them the mineral deposits to mine, nor would many unclaimed deposits be available to them in West Germany.

WHY, WHEN, AND HOW ENTERPRISES MOVED

With the nature of the refugee businesses having been established, the basic questions arise as to why, when, and how they transferred to West Germany.

The question of why the concerns that were expelled from their former locations transferred answers itself. The owners, as the actual agents expelled, simply were ordered out and had to move elsewhere. They had no other choice.

The entrepreneurs who voluntarily left Berlin or the rest of the Soviet Zone had several choices, and the reasons for their transfers are more revealing. Unfortunately, only general statements can be made, and no scientific analysis is available—only random sampling. Even so, the explanations are sufficiently logical, reasonable, and universal that they can be assumed to be applicable to a great many cases. In random interviews, the writer was told by managers of refugee industries from the Soviet Zone that they left East Germany because of (1) fear that their industries would be expropriated outright by the Communists (either the Russians themselves or the Soviet Zone German authorities), with the equipment perhaps to be sent to the Soviet Union; (2) fear that even if they were left alone, they would have difficulty operating in the Communist economy because of red tape, materials shortages, or nuisance investigations; (3) realization that East German recovery was lagging; (4) discovery that markets were restricted for Soviet Zone plants manufacturing for export, both because of Soviet controls and of unreliable exchange rates; (5) lack of capital; (6) inability to secure machines and other equipment, as well as raw materials; and (7), certainly not the least reason, fear for personal safety. Many true refugees knew that conditions in West Germany were—in the first few postwar years—difficult and that there would be problems for refugee businesses. But they believed that they could only better their positions by moving to West Germany, and there they could feel secure in regard to their personal safety.

Timing of the flow of "industries" into West Germany is largely a function of the flow of refugees themselves. Since 70 per cent of the refugees in West Germany had arrived by October, 1946, it may be presumed that approximately that percentage of refugee industries had left their former locations by that time. The years 1947, 1948, and 1949 witnessed a considerable number of refugee arrivals, but the number decreased thereafter.

More significant than the time when the industries left is the time when they actually resumed operations in West Germany. Again, the explanation lies in a set of general circumstances. The first 24 to 30 months after the collapse of Germany were a time of chaos gradually leading to reorganization. Yet refugees poured into West Germany by the millions. Their early care was entrusted to the local governments of the states newly created by the four occupational powers. Each year saw economic improvements as the three western zones were brought closer together. With the introduction of the new Deutsche Mark money in 1948, economic confidence soared. By 1951–52, West Germany was facing a boom.

Against this background, one could safety conclude that refugee industries were founded in considerable and increasing numbers from 1945 until 1947 and that 1948 was a peak year, with the decrease thereafter being more rapid than the buildup theretofore. Random sampling showed such to have been the case. Incomplete West German official figures show the same conclusion. Specific figures for years of beginning of 247 industrial plants (not all refugee) founded since 1945 in the state of Niedersachsen may well be indicative of the time of re-establishment of refugee industries in all of West Germany:[2]

1945	27	1949	53
1946	35	1950	27
1947	38	1951	5
1948	61	1952	1

In summary, then, it appears that most of the refugee industries began operations in West Germany between 1946 and 1950.

At this point, the question arises as to just how the transfers of the industries were made. Any answer other than a rather general one would be not only complex but also interminable, since the method varied with the individual expellee or refugee and with the individual concern. Some of the transfers were made under dramatic cloak-and-dagger conditions demanding great courage and a strong will to survive. The refugees who voluntarily left the Soviet Zone and entered West Germany especially exposed themselves to dangers, particularly if the material they attempted to bring was bulky or large in quantity. Frequently the transfer was simply that of one man—sometimes a man with his family—who came with empty hands and pocketbook but with know-how in his head. Some migrants brought a few books, manuals, or blueprints; possibly a few tools or dies; or, if they were very lucky—and cautious—a few machines or key personnel. A large number of firms, including the famous Zeiss optical company, left Thüringen with the Americans when the United States Army pulled back and turned the area over to the Russians. Equipment and stocks smuggled into West Berlin could be rather easily transported to West Germany. However, the obvious fact is that by far most of the shop and plant equipment, retail stocks, scientific instruments, books, or other basic materials needed by the fugitive establishments had to be procured in West Germany when the enterprises were

FIG. 3. Länder (states) and Regierungs-Bezirke (Administrative Districts) of West Germany. The shaded area represents the former French Zone of Occupation.

[2] Adapted from Wolf Müller, "Untersuchungen über Struktur und Standort von Industriegründungen in Niedersachsen in der Zeit von 1939 bis 1951"; *Neues Archiv für Niedersachsen*, Jahrgang 1953, Heft 1–2, p. 20.

reopened there. Ironically enough, many of the fugitive industries are now competing with their own former companies, taken over and operated by unintended successors in the areas from which the fugitives fled.

AREAS OF ORIGIN OF REFUGEE ENTERPRISES

The original locations of the 85,127 fugitive business enterprises that existed in West Germany in 1950 are grouped into six general areas, suggested by the six lightly stippled circles in Figure 4: (1) the Saar, (2) Czechoslovakia (primarily the Sudetenland), (3) the Soviet Zone of Occupation (excluding Berlin), (4) Greater Berlin, (5) all areas east of the Oder-Neisse Line that were part of 1937 Germany (including East Prussia, as is suggested by the dashed line into that area), and (6) all other areas—principally Poland, but also including Danzig, Hungary, Soviet Union (including Memelland and the former Baltic states), Rumania, Yugoslavia, and Austria (in approximately that order), as well as other European countries. In Figure 4 the dashed lines into Austria and Hungary from the circle in southern Poland suggest the applicability of this symbol to areas in addition to Poland. The number of refugee enterprises formerly situated in any given area would logically be expected to be in proportion to the number of individual fugitives from that area. Although such a rough proportion exists, other variables affect the ratio of refugee enterprises to individual

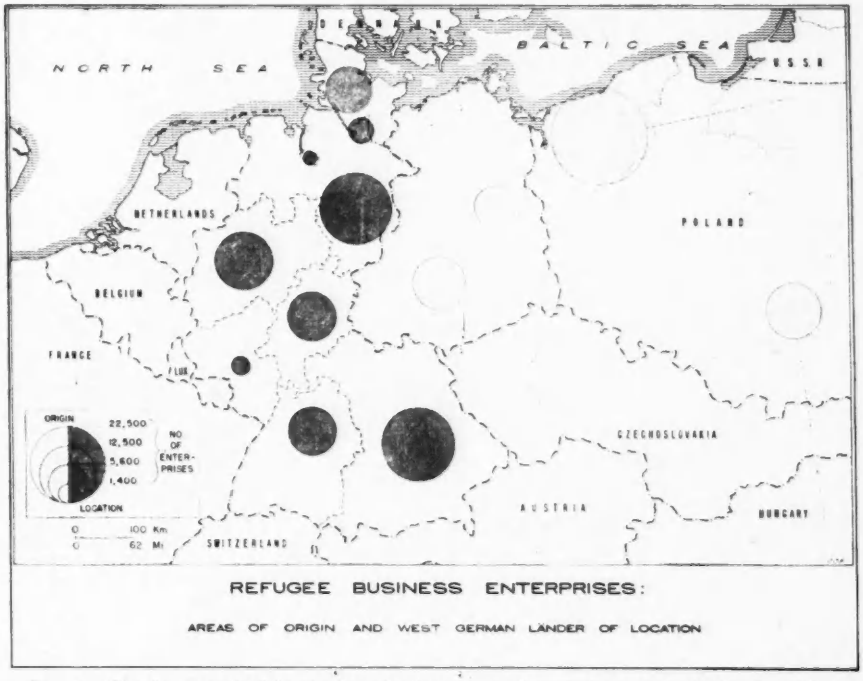


FIG. 4. The six areas of origin of refugee business enterprises are (west to east): Saarland, Soviet Zone of Occupation (German Democratic Republic), Greater Berlin, Czechoslovakia (mostly the Sudetenland), areas east of the Oder-Neisse Line that were part of pre-1938 Germany (including East Prussia), and all other areas.

refugees: the nature of the economy in the former homelands, geographical proximity, and character of the migrating group.

Figure 4 shows that of the six general areas of origin named above, the territories east of the Oder-Neisse Line supplied more enterprises than any other area. These territories were formerly the homelands of 37,085 establishments and 4,423,000 fugitives, a ratio of 1 enterprise to 119 fugitives, about average for the six areas. Czechoslovakia supplied 18,292 enterprises and 1,912,000 fugitives for a 1:104 ratio, highest of all the areas of expulsion. Such a ratio indicates a high degree of skill and determination among the former Sudetenlanders. The "all other countries" group of areas supplied 11,829 enterprises and 1,495,000 fugitives for a 1:126 ratio, lowest of all the areas of expulsion except the Saarland, which supplied only 263 enterprises and 47,000 fugitives for a 1:179 ratio. The Soviet Zone supplied 11,123 enterprises and Berlin 6535. These two were the former homelands of 1,500,000 true refugees and thus jointly have the very high enterprise-refugee ratio of 1:85, a result of the facts that (1) the refugees had greater opportunity to shift their enterprises, since they usually chose their own time to migrate, were close to West Germany, and could use the transportation lines between Berlin and West Germany; (2) fugitives from these two areas are more skilled and are more likely to have had businesses of their own; and (3) they are economically aggressive—especially the Berliners.

PRESENT LOCATION OF REFUGEE ENTERPRISES

The distribution of refugee enterprises by states or Länder (identified in Figure 3) in West Germany, shown by the nine darker proportional circles in Figure 4, reveals the same relatively uneven pattern as does the distribution of refugees themselves.[3] True, the two largest states, Bayern (Bavaria) and Niedersachsen (Lower Saxony), have the largest number of refugee enterprises—approximately 20,000 each. But Schleswig-Holstein, the smallest state (excepting only the two city-states of Hamburg and Bremen), received 8563 enterprises, only slightly fewer than the much larger states of Baden-Württemberg and Hessen. Nordrhein-Westfalen, containing the heavily industrialized Ruhr, was host to the third largest number of refugee enterprises. The city-state of Hamburg alone received twice as many establishments as the entire state of Rheinland-Pfalz (Rhine-Palatinate), and even Bremen received more than half the number to which Rheinland-Pfalz played host. The factors that account for this pattern can better be studied after considering other aspects of the distribution of refugee enterprises in the Federal Republic.

Figure 5 maps by dots the locations of the 85,127 refugee business enterprises symbolized more generally by the darker circles in Figure 4. Again the striking sparsity of enterprises in the Rheinland-Pfalz is shown. In addition, the dots reveal that the establishments in Baden-Württemberg are concentrated in the northern half of the state, especially in and around Stuttgart and along the Neckar River. The southern half of the state has the same sparse scattering of dots seen in Rheinland-Pfalz. Comparison with Figure 3 will reveal that the area with widely scattered dots coincides exactly with the former French Zone of Occupation, from which refugees were barred

[3] For refugee distribution, see Harris and Wülker, *op. cit.*, p. 15.

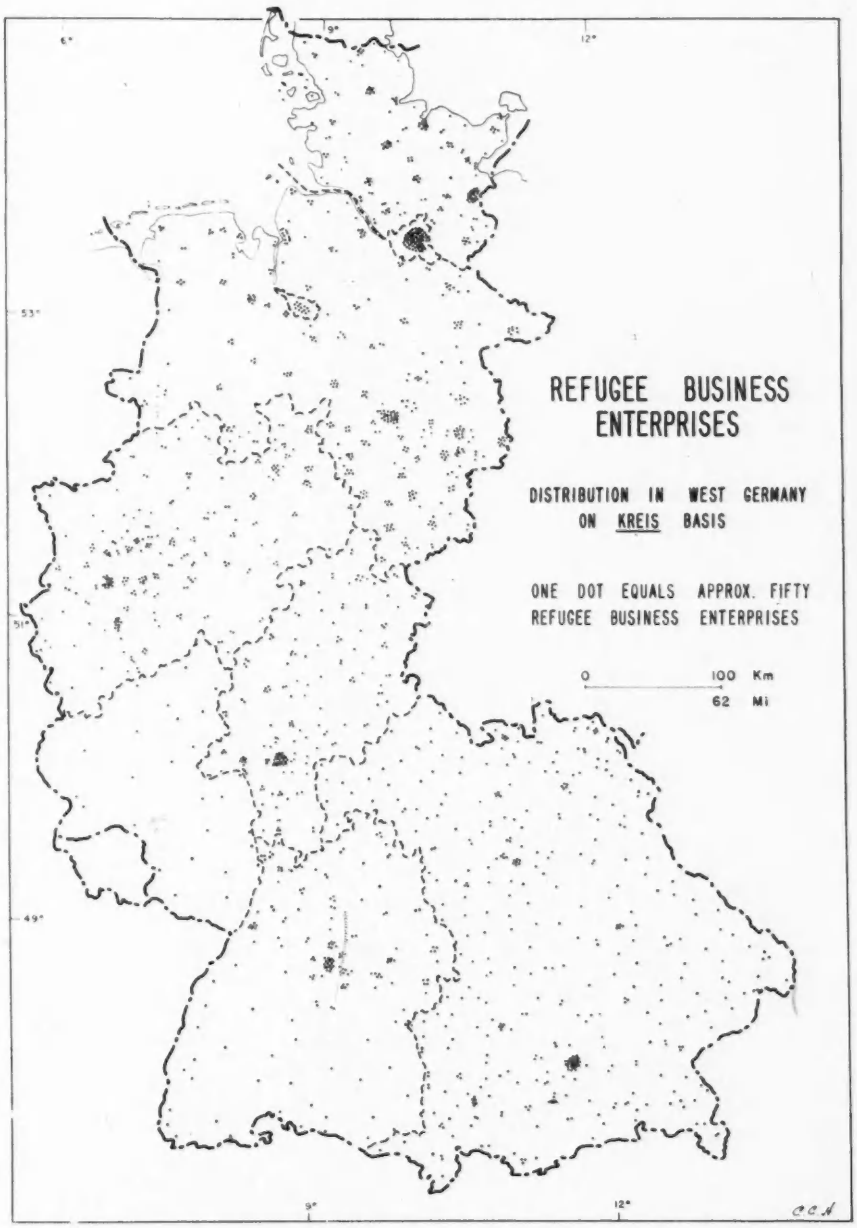


FIG. 5. Dot map of distribution of all refugee nonagricultural enterprises in West Germany. All categories shown in Figure 1 are included.

for the first four postwar years. Even so, the area formerly included in the French Zone was, with a few exceptions, relatively less densely populated and less industrialized than adjacent parts of the British and American zones, and it was also farthest removed from the main source-areas of refugees. Another striking feature of Figure 5 is the tendency toward small-scale clustering of enterprises in the heath-moor-marsh areas of northern Niedersachsen and of much of Schleswig-Holstein. These concentrations mirror the pattern of distribution of villages and towns in this agriculturally poor region. In contrast to the lightly dotted areas, large clusters appear in certain metropolitan areas, although not necessarily in the center of those cities. The Regierungs-Bezirk names in Figure 3 will help somewhat in locating many of the metropolitan centers. Clusters appear in Lübeck, Hamburg, Bremen, Hannover, Braunschweig, several Ruhr and Rhine cities, Frankfurt, Stuttgart, Nürnberg, and München. The distribution in Bayern is remarkably uniform.

A third aspect of the distribution of refugee nonagricultural enterprises in West Germany may be seen in Figure 6. As in the West German portion of Figure 4, the basic unit is the Land, but here the purpose is to show what relation the number of refugee business enterprises (black sector) bears to (1) the number of other concerns established between 1945 and 1950 (dark gray sector), and (2) the total number of all enterprises in each Land (complete circle). The data that form the basis for Figure 6 are of sufficient interest to merit tabular as well as cartographic presentation (Table I).

It is incidentally noteworthy that in each state except Rheinland-Pfalz the percentage of new enterprises is more than 25 per cent of all existing ones. In Schleswig-Holstein and Hessen, the new establishments exceed 36 per cent of the state total. Among the states, refugee enterprises constitute from 0.8 per cent in Rheinland-Pfalz to 8.5 per cent in Schleswig-Holstein, averaging approximately 3.75 per cent (*cf.* bottom bar in Fig. 1). The facts illustrated in Figure 6, then, again adduce the large share of refugee enterprises that fell to Schleswig-Holstein and Niedersachsen especially and to Bayern and Hessen to a smaller extent.

LOCATION OF REFUGEE INDUSTRIES

Up to this point, the discussion has been primarily concerned with the entire group of refugee nonagricultural

TABLE I

REFUGEE BUSINESS ENTERPRISES

Länder	*Total number all business enterprises*	*Number established since 1945*[a]	*Per cent of total*	*Number refugee enterprises*	*Per cent of total*
Schleswig-Holstein	100,993	37,109	36.7	8,563	8.5
Hamburg	95,590	32,500	34.0	2,825	2.9
Niedersachsen	273,392	91,779	33.6	19,283	7.1
Bremen	29,884	8,837	29.7	761	2.5
Nordrhein-Westfalen	549,144	147,579	26.9	13,556	2.5
Hessen	223,924	81,063	36.3	9,240	4.1
Rheinland-Pfalz	155,585	30,929	20.0	1,333	0.8
Baden-Württemberg	342,765	102,702	30.0	8,896	2.6
Bayern	494,984	158,404	32.0	20,674	4.2

[a] Including refugee enterprises.

enterprises. The question now arises as to what relationships exist between this larger category and the smaller subcategory of "productive industries," mining and manufacturing. Economic Divisions 1 (mining), 2 (metal products manufacturing), and 3–4 (nonmetal manufacturing) of the German census, shown in Figure 1, encompass the productive industries; and Economic Groups 11 through 49 specify them in detail, as in Figure 2. With a total of 31,767 enterprises (only 436 of which are mining concerns) included in Divisions 1, 2, and 3–4, refugee mining and manufacturing establishments thus comprise 37 per cent of the total of 85,127 fugitive nonagricultural undertakings of all types.

Figure 7 reveals the locations of the 31,767 refugee mining and manufacturing industries in West Germany. It should be noted that in Figure 5 one dot equals about 50 business enterprises of all types and that in Figure 7 one dot equals about 15 mining and manufacturing enterprises in order to make the two figures more easily comparable. Figure 7 reveals that productive industries distributed themselves as widely over West Germany as did service and commercial establishments. No more remarkable concentrations exist in Figure 7 than in Figure 5. Indeed, it is the other way around. The larger urban centers seem to have attracted more services and commerce than industry. Bremen and Nürnberg disappear as outstanding concentrations of refugee industry in comparison with

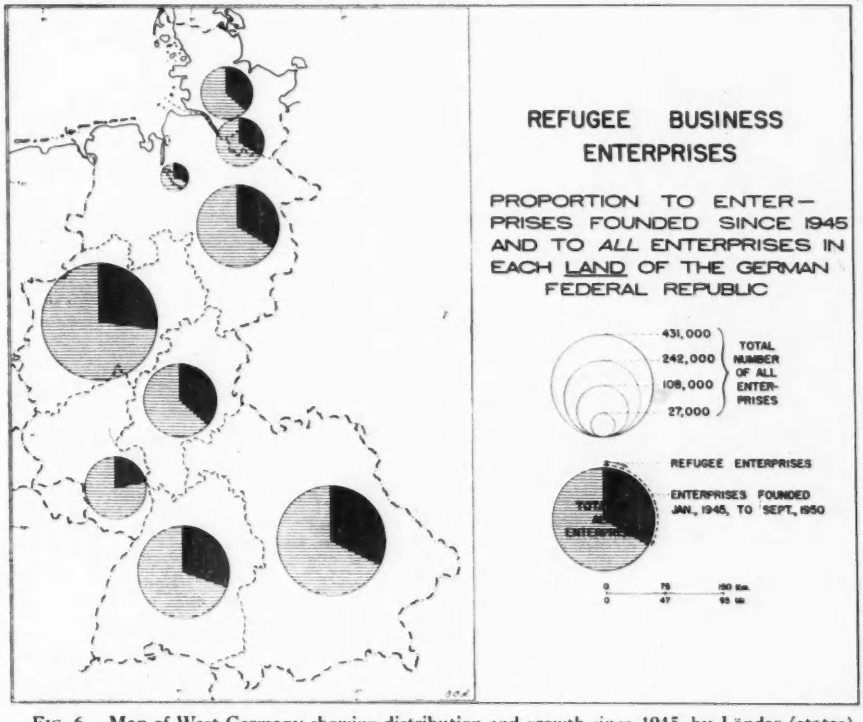

REFUGEE BUSINESS ENTERPRISES
PROPORTION TO ENTERPRISES FOUNDED SINCE 1945 AND TO ALL ENTERPRISES IN EACH LAND OF THE GERMAN FEDERAL REPUBLIC
431,000
242,000
108,000
27,000
TOTAL NUMBER OF ALL ENTERPRISES
REFUGEE ENTERPRISES
ENTERPRISES FOUNDED JAN., 1945, TO SEPT., 1950

FIG. 6. Map of West Germany showing distribution and growth since 1945, by Länder (states), of all types of nonagricultural economic enterprises.

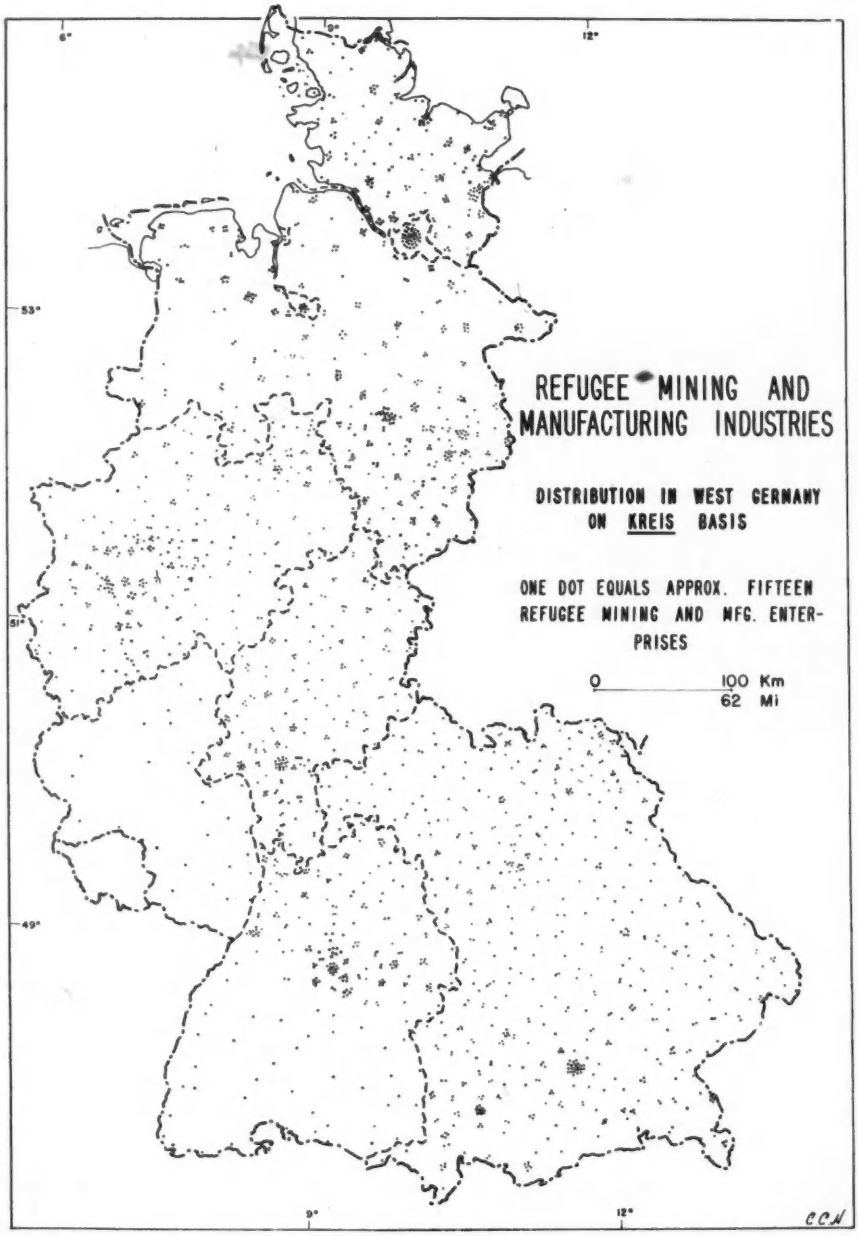


FIG. 7. Whereas Figure 5 shows distribution of all refugee nonagricultural enterprises, this map shows distribution of mining and manufacturing industries only (Economic Groups graphed in Figure 2).

their rank as concentrations of refugee business enterprises of all types. The other clusters remain: Lübeck, Hamburg, Hannover, Braunschweig, the Ruhr-Rhine areas, Frankfurt, the Stuttgart-Upper Neckar area, and München.

Figure 8 reveals the importance of the number of refugee mining and manufacturing enterprises in comparison to the number of *all* such enterprises in each of the 36 Regierungs-Bezirke (shown in Fig. 3) of West Germany. Depending upon the viewpoint, the map shows to what extent each Bezirk was already industrialized before the addition of the refugee establishments, to what degree the industrialization in each Bezirk is the result of the influx of refugee concerns, and in what measure industrialized Bezirke did not attract—for whatever reason—refugee industrial enterprises. The 2949 refugee industries in Schleswig-Holstein (which comprises only a single Regierungs-Bezirk) constitute nearly 11 per cent of the total of 27,673 industries in the Land. This figure of 2949 is the largest that any Bezirk has attracted and also makes up the greatest percentage of all industries in any one Bezirk. Interestingly enough, the two next highest percentages are in the Bezirke south of Schleswig-Holstein and along the boundary between West and East Germany —Lüneburg and Braunschweig. The seven Bezirke that formerly constituted the French Zone in the southwestern corner of the Federal Republic all show a small black sector, since the percentages vary from only 0.7 (in Trier) to only 1.3 (in Südwürttemberg-Hohenzollern). In between the extremes of about 10 per cent in the three northeasternmost Bezirke and about 1 per cent in the seven southwesternmost Bezirke, the percentage constituted by refugee industries of the total of all industries varies from more than 8 in three Bezirke in Niedersachsen to 1.5 in Aachen.

GEOGRAPHICAL ORIGIN-DESTINATION RELATIONSHIPS

One more aspect of the distribution of refugee industries must be considered before general conclusions can be drawn: the geographical relationships that exist between the present location of an industry and the area from which it came. Did the industries from one area tend to locate in any particular part of West Germany?

In order to eliminate a number of variables that might mask the realities of the relationships, one particular Economic Group was selected as a test —Group 28 in Figure 2, industries manufacturing precision and optical goods. Although the distribution of

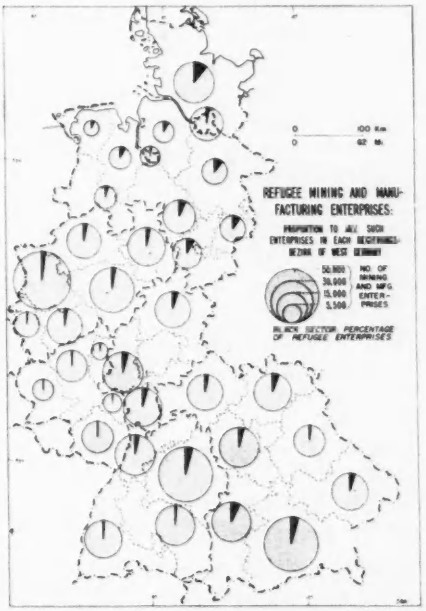


FIG. 8. Proportional circles show number of mining and manufacturing industries in the Regierungs-Bezirke (Administrative Districts), labeled in Figure 3. Black sectors show percentage comprised by refugee industries.

these industries, like that of many others, might be influenced by certain specific locational factors, Group 28 was selected because its producing units can adapt to varying circumstances and have considerable flexibility in locating. The wide distribution of the units in Figure 9 is proof of the choice that the producers had in locating their plants.

Each of the 1269 dots in Figure 9 symbolizes one factory or specialized repair shop. The general similarity to Figures 5 and 7 is striking: The centers of concentration are generally the same among the three maps. Figures 10, 11, and 12—all three of which likewise have the one dot-to-one factory ratio—reveal which of the units shown in Figure 9 moved from formerly German territory east of the Oder-Neisse Line, the Soviet Zone (German Democratic Republic), and Czechoslovakia, respectively. Plants from the Saar and Berlin are too few to consider, whereas those (177 in number) from foreign areas other than Czechoslovakia have such diverse origins that their present distribution reveals nothing that Figure 10 does not.

The 546 precision and optical goods industries that moved into West Germany from east of the Oder-Neisse show two tendencies in relocating (Fig. 10): The majority of them moved westward across the North German Plain and recommenced operations in the northern states almost to the western frontier, but an appreciable number continued southward once they reached West Germany. Having been completely uprooted in the east and having crossed the Soviet Zone, they had some fluidity of movement. Plants from the Soviet Zone, 201 in number, moved less widely in general (Fig. 11). They tended to move just inside West Germany or else to follow the main rail and canal lines westward. The pattern of plants formerly in Czechoslovakia shows the most striking influence of former location (Fig. 12). Former Czech industries making precision and optical goods rather obviously moved just inside West Germany and resettled in Bayern and Hessen. Only a scattered few went to other states.

In industry after industry the story is the same: Mere geographical proximity exercised a powerful influence in attracting manufacturing establishments. Even the French Zone, although technically closed to refugees and refugee industries for four years, received some industries from the Saar and from France. Thus, a given state in West Germany might receive some refugee industries from all six areas from which refugees came, but the given state tended to receive a greater percentage of its refugee industries from those supply areas geographically nearer to it. Bayern, for example, served as host to many more industries from Czechoslovakia than from the area east of the Oder-Neisse Line. Conversely, Niedersachsen received relatively few industries from Czechoslovakia, but absorbed a great percentage of its refugee mining and manufacturing enterprises from east of the Oder-Neisse. Schleswig-Holstein is especially one-sided in the areas of origin of its refugee industries.

FACTORS OF RELOCATION

The study thus far has been primarily devoted to a description of the pattern of distribution of refugee industries in West Germany. Some broad factors affecting the pattern have already been discussed: (1) Refugees, and therefore refugee industries, were excluded from the French Zone of Occupation for four years, during the period of greatest influx of fugitives. Hence, the area of

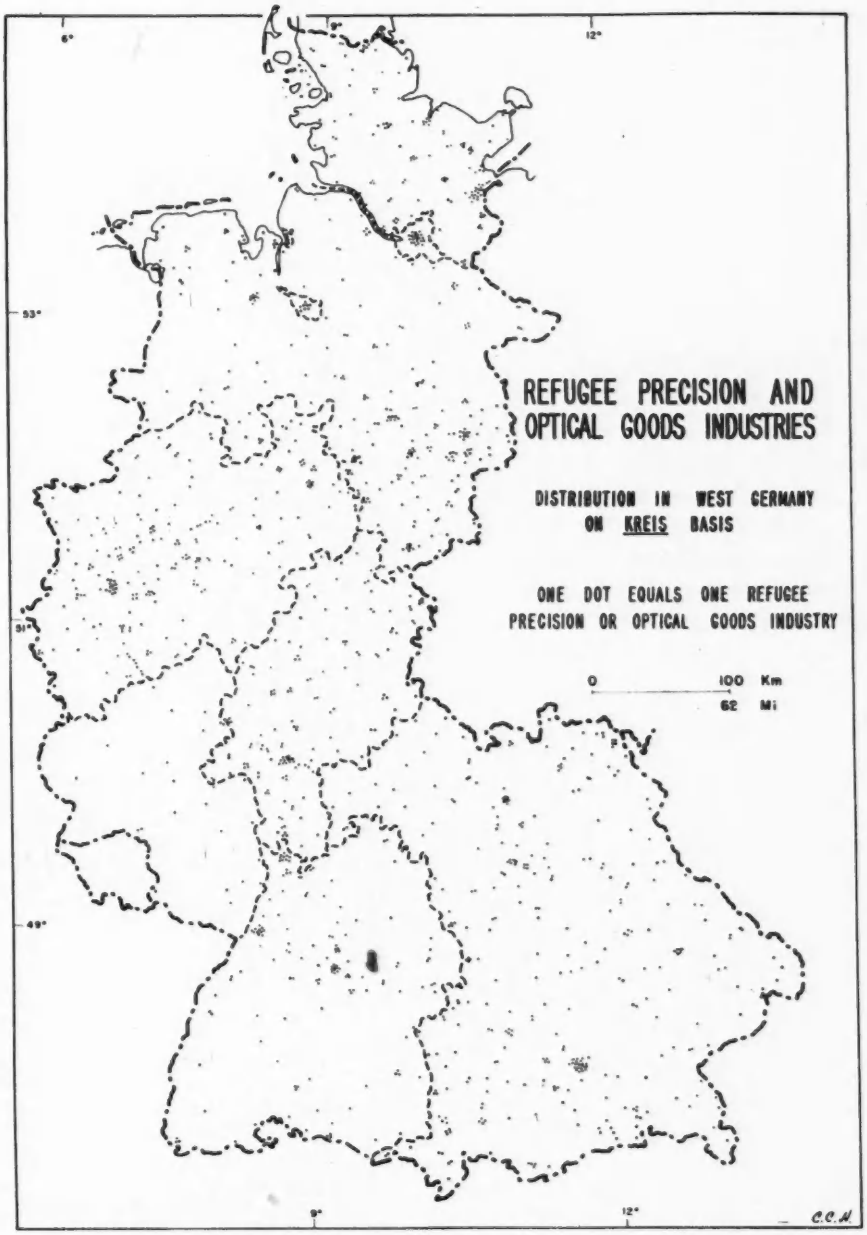
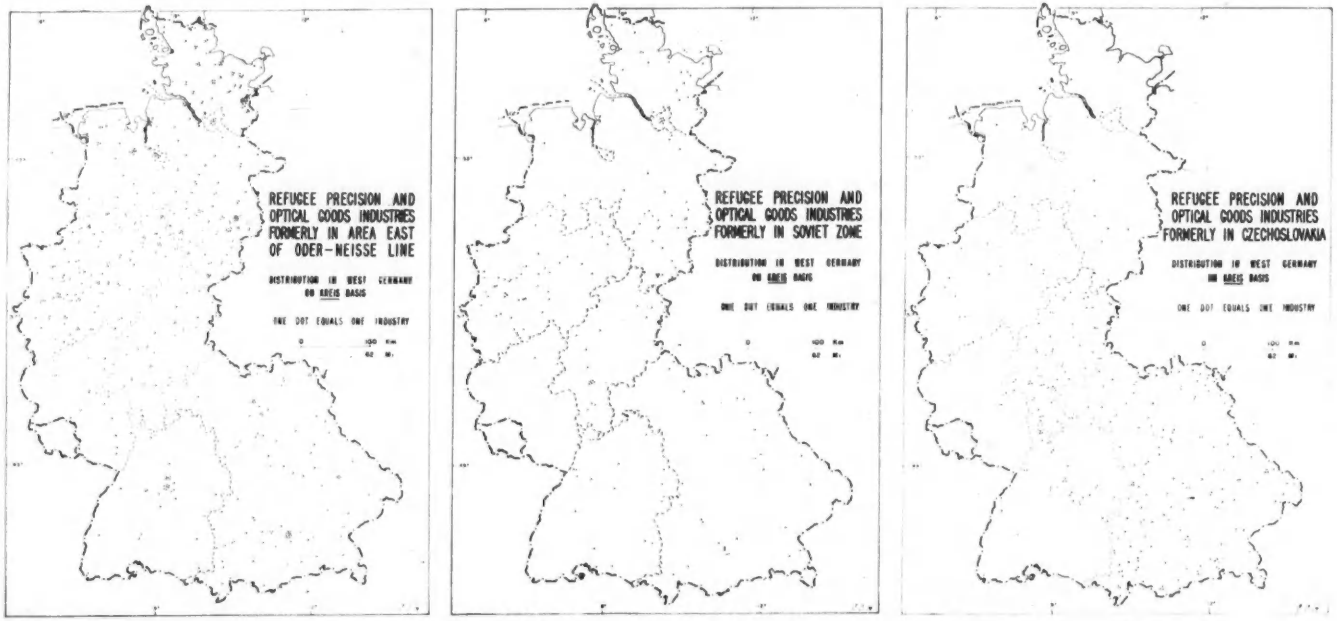


FIG. 9. This map of industries in Group 28 (see Fig. 2) is a composite of Figures 10, 11, and 12, plus plants from other areas (see text).


REFUGEE PRECISION AND OPTICAL GOODS INDUSTRIES FORMERLY IN AREA EAST OF ODER–NEISSE LINE
DISTRIBUTION IN WEST GERMANY ON KREIS BASIS
ONE DOT EQUALS ONE INDUSTRY
REFUGEE PRECISION AND OPTICAL GOODS INDUSTRIES FORMERLY IN SOVIET ZONE
DISTRIBUTION IN WEST GERMANY ON KREIS BASIS
ONE DOT EQUALS ONE INDUSTRY
REFUGEE PRECISION AND OPTICAL GOODS INDUSTRIES FORMERLY IN CZECHOSLOVAKIA
DISTRIBUTION IN WEST GERMANY ON KREIS BASIS
ONE DOT EQUALS ONE INDUSTRY

FIGS. 10–12. These three maps trace the origin-destination relationships of one sample group of industries (Group 28 in Fig. 2).

West Germany formerly comprising the French Zone (shaded in Fig. 3) shows up prominently in all the maps as having few refugee enterprises of any type. (2) Sheer geographical proximity has given some West German states a share of refugee enterprises larger than that of states more distant from source areas. The proportional share of refugee enterprises received by each state is about the same as the proportional share of refugees received by each state. (3) As Figure 8 shows, some previously industrialized areas have attracted refugee enterprises (note Regierungs-Bezirke Oberbayern—with München as center, Nordwürttemberg—with Stuttgart as center, and Wiesbaden—with Frankfurt-Wiesbaden as industrial core), whereas others have not done so (note Regierungs-Bezirke Düsseldorf, Arnsberg, and Hamburg).

Other broad factors and a number of detailed factors also merit consideration. One of the most important is the inability of some areas to absorb refugee industries because of extensive war damage. Such damage reduced available buildings for industries and available housing for incoming refugees and for employees that they might need in their relocated factories. Refugee industries were actively discouraged from opening in some such areas, although the discouragements were sometimes only partially successful. As a result, a number of refugee industries were poorly and inefficiently housed; but they were well located with respect to transportation, markets, and labor.

The very lack of industries in some areas was an advantage for some of the refugee concerns. From another viewpoint, such a lack was the reason why state and federal authorities charged with helping refugee plants relocate encouraged the owners to accept such areas for re-establishing their plants. Thus, the "burden" aspect of the refugees was more equitably distributed geographically, and the "advantage" aspect of the new industries created new local jobs and new facets to local economies.

It is, of course, a significant fact that the industries had sufficient flexibility or mobility to be transferred in the first place. In most cases, then, the industries that are included in this study are restricted in character by the very processes of selection that have operated upon them. It has already been shown, for example, that extractive industries and certain heavy industries could not and did not transfer and are, therefore, poorly represented among the refugee industries. As a result, the inherent character of the industries gave their owners somewhat greater freedom of choice of site than owners of industries of a more general cross-section would have.

However, this greater freedom of choice was limited by other facts and factors. Occupational forces, state authorities, and—later—the Federal government exercised considerable influence on relocation of industries. Financial aid was given to most of the industries, but the aid had certain strings attached: Assistance was conditional upon the industry's relocating where planners had decided overall strains would be least.

Above all, the owners had to be practical. Construction or remodeling had to be kept to a minimum, since—in the early years—such work was almost impossible to get done, or—later—construction costs were high and materials difficult to obtain. The general result was that traditional factors in plant location were somewhat upset. Often, minor locational factors came to be decisive.

Müller's study[4] and random sampling by the writer show that an available building for the industry was the most common decisive factor in the relocation of the plant! Then in order of importance in determining location follow favorable transportation, nearness to market, favorable wage scale, availability of raw materials, dependence on other local industries, and other factors on down to favorable tax policy (which was rare).

Such locational factors led owners to reopen their plants more in the smaller and medium-size towns, especially if such towns were near large cities. But the metropolitan centers themselves were usually avoided because of the bomb damage usual in such cities. Often mere villages received modest industries, and especially was this true of Alpine villages with skilled labor particularly available during the winter months.

One final point should be made in regard to locational factors. The Federal Republic inaugurated a vigorous program of refugee resettlement in 1949 in order to ease the burden imposed by the concentration of refugees in Schleswig-Holstein, Niedersachsen, and Bayern. By the end of 1953, 600,000 refugees (both expellees and true refugees) had been moved out of the three states just named and had been resettled especially in Nordrhein-Westfalen, Baden-Württemberg, and Rheinland-Pfalz. This resettlement program will certainly fill in some of the empty spaces in the former French Zone; but, generally speaking, the resettlement does not involve those refugees who have found a niche in their own business enterprises or some other regular employment.

SIGNIFICANCE OF SHIFTS

Among the staggering changes wrought by the influx of fugitives into West Germany, the alteration of the industrial structure by the addition of refugee industries is obviously of considerable magnitude. And the alteration is important not only to West Germany alone, but also to Western Europe and the Free World.

Although the Federal Republic cannot hope to give an independent economic existence to all those refugees who formerly possessed it, West German authorities have attempted and are attempting to aid as many as possible to recover their economic independence. Whether as employer or employee, the refugee can best be absorbed economically into German industry; and in this light, the actual industrial enterprises that the refugees brought with them, in whatever form or circumstance, assume a greater significance.

The future of refugee industries in West Germany is, of course, difficult to assess in the light of the questionable political-geographical future of Germany, not to mention the difficulty of economic predictions in general. Logic suggests, however, that thousands of the new industries will remain in West Germany whatever happens. The owners will have made the necessary ties to the new locations and will be satisfied to stay where they are. Others will return to their former homelands at the first safe opportunity, should Germany be reunited. Interviews with refugee businessmen reveal such to be the thought at this time. No one suggested returning to Communist Germany, and no one would be permitted to return to lands east of the Oder-Neisse even if he were to wish to do so. Whether most of the refugee industries will be able to survive after the West German boom levels off is more difficult to say. Some undoubtedly will have to close

[4] *Op. cit.*, p. 24 ff.

up, but there is no reason why refugee industries as such should not have as bright a future as other industries in West Germany.

The East—the Communist world—has lost a great reservoir of know-how and skilled labor in losing the fugitives who came into West Germany. It similarly lost thousands of producing units, although in many cases the Communists took over the plants and expelled the personnel. The East's loss is the West's gain. For although the refugees are an unprecedented burden on the West German economy, and although their absorption has demanded enormous mutual sacrifice, the keen competition and will to survive that refugee businessmen and workers have furnished must be credited with an important share in the so-called "miracle" of West Germany's recovery.

CEBU: FOCUS OF PHILIPPINE INTERISLAND TRADE*

Frederick L. Wernstedt

Dr. Wernstedt is Assistant Professor of Geography at the Pennsylvania State University. He did field work in the Philippine Islands for his dissertation, supported by Fulbright and Social Science Research Council grants, in 1951–52; and spent the summer months of 1954 and 1955 in a continuation of his studies in the Islands on a grant from the Office of Naval Research.

THE economic relations and connections between areas are reflected in the character of transportation facilities and in the flow of trade."[1] Whereas considerable literature exists on the role of water transportation in the economies of nations, it concerns itself mainly with international ports and overseas trade. The role of water transport in archipelagic nations generally has been neglected. The port of Cebu, a major focal point of Philippine interisland trade, reflects the importance of water transport in an insular nation.

Philippine Interisland Trade

The importance of those Philippine ports primarily serving domestic commerce is overshadowed by the glamour of Manila as the Philippines' principal international port and capital. In an island-studded nation such as the Republic of the Philippines, trade and commerce by water become critical to national, political, and economic unity. In the Philippines this natural need is heightened by the development of hundreds of separate producing areas, each supplying commodities to or requiring goods from other regions. Within Manila's shadow are hundreds of ports, several of important stature, designed to handle and facilitate the flow of interisland commerce. Among the ports of the Philippines the port of Cebu has no peer with respect to domestic trade.

The daily life of the average Filipino always has been oriented strongly toward the sea. Prior to the arrival of the Spaniards, many small vessels plied between the various islands, primarily the more important islands of Luzon, Mindanao, Samar, Leyte, Panay, Negros, Cebu, and Jolo in the Sulu Archipelago (Fig. 1). At the same time a fairly active overseas trade was maintained with China, Japan, and Borneo, largely by means of Chinese junks. Domestic and foreign contacts were forbidden or placed under stringent regulation with the establishment of the Spanish administration. Interisland travel by Filipinos was discouraged and foreign trade was confined to the port of Manila to facilitate Spanish control. Changes in Spanish monopolistic philosophy came about gradually, owing in no small measure to the demands of other foreign powers. As a result Manila was declared an "open port" to foreigners in 1830, followed by the opening of Sual (Pangasinan), Iloilo,

*Grateful acknowledgment is made for financial assistance from the Geography Branch of the Office of Naval Research. Reproduction in whole or in part is permitted for any purpose of the United States Government.

[1] Edward L. Ullman, "Transportation Geography," in *American Geography: Inventory and Prospect*, ed. by P. E. James and C. F. Jones, Syracuse University Press, 1954, p. 311.

and Zamboanga in 1855, and Cebu in 1860.

Foreign trade received great stimulus from the liberalization of Spanish policy. Areas with favorable growing conditions undertook the production of specialized commodities destined for export, e.g., sugar, tobacco, and Manila hemp. Other areas produced food surpluses, with which they supplied these one crop regions. The need for the concentration of export products at the "open ports" and the supplying of foodstuffs to these deficit areas created a great demand for interisland transport. The present-day patterns of interisland trade evolved from these needs.

The United States administration, inaugurated at the turn of the Twentieth Century, inherited a decimated interisland shipping fleet, owing to losses suffered during the Spanish-American War and the subsequent Filipino-American conflicts. With the re-establishment of political stability, the new government immediately began an extensive rebuilding program, the foundation of which was supplied by several American coast guard vessels. Ports in existence during the Spanish era were rehabilitated and modernized, and hundreds of smaller national ports were constructed in all parts of the Archipelago. By 1941, a reasonably adequate interisland shipping fleet existed with mail, passenger, and freight services to all important ports. The Pacific War, 1941–1945, wrought tremendous destructions to the fleet.[2]

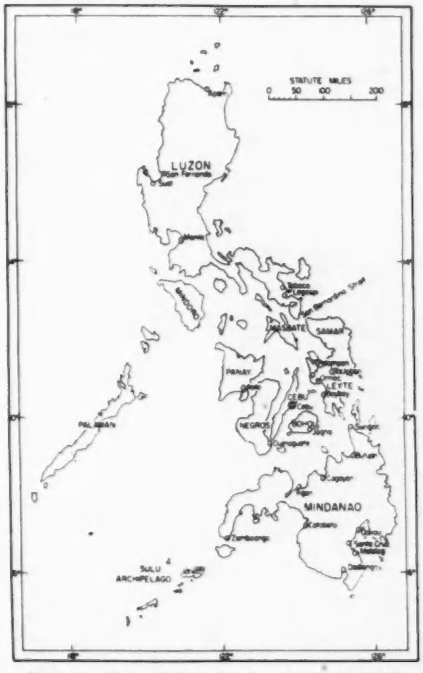


FIG. 1. General locational map of the Philippine Islands.

CEBU INTERISLAND SHIPPING AND TRADE

Throughout all stages in the evolution of Philippine interisland shipping and trade, the port of Cebu has maintained a position of dominance. Cebu has attained its premier position with respect to Philippine domestic trade through the interaction of several physical and cultural geographic factors.

Site and Regional Location

Adequate physical harbor facilities and a strategic location within the Archipelago have been the primary factors in the growth of the port of Cebu.

Cebu affords one of the better physical harbors in the Philippines. The city of Cebu is situated on a narrow alluvial plain at the foot of the central limestone range which traverses the entire length of the island. The harbor is located in the strait which separates the small offshore island of Mactan from the eastern

[2] Statistics of shipping destroyed in the Philippines during World War II are incomplete. Figures secured in 1954 at the ports of Manila, Cebu, San Fernando, Aparri, and Legaspi-Tobaco indicate that approximately 85 per cent of present Philippine interisland shipping has been constructed since 1942.

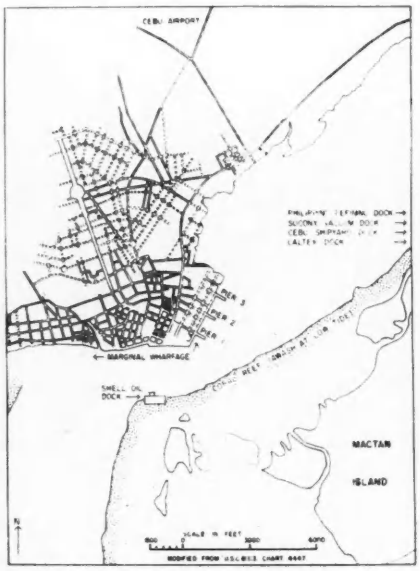


FIG. 2. The port of Cebu.

shore of the larger main island of Cebu. Mactan Island provides protection from northeastern winds and occasional typhoons (Fig. 2). The harbor can be entered by all classes of vessels either from the northeast or from the south. The width of the harbor is 500 to 600 yards, and the general depths are thirty feet. Berthing space consists of 5413 feet of marginal wharfage and three piers. In general, interisland vessels are assigned marginal wharfage, and Piers One and Two are reserved for foreign vessels. Four additional piers are located on nearby Mactan Island, and the Shell Oil Company maintains petroleum wharfage on an artificial island in the harbor. There is no cargo handling equipment at Cebu, and loading and unloading must be accomplished by ship's tackle.

Cebu's position in the center of the Philippine Islands has given the port a strategic regional location with regard to interisland trade. Cebu lies approximately midway between Manila and Davao, the two most important interisland freight and passenger terminal and originating ports. Similarly Cebu's central position makes it the logical site of the commercial center for the eastern and central Visayan Islands, the rather densely populated central Philippine islands. Thus, within short distances of Cebu are located the primary producing centers of eastern Negros, Bohol, Leyte, Samar, northern Mindanao, and various smaller islands. The proximity of important San Bernardino Strait gives Cebu an advantageous position for overseas Pacific shipping. Cebu is closer to the United States west coast ports than is Manila.

Historical Development

A part of Cebu's present importance in domestic commerce must be ascribed to its historical primacy. Ferdinand Magellan, the great Portuguese explorer in the service of Spain, landed at Cebu and was killed on Mactan Island in 1521. Although his expedition founded no settlement, the way was blazed for Magellan's successors. A subsequent expedition under Miguel Lopez de Legaspi established Cebu as the seat for Spanish conquest of the Philippines in 1565. The seat of Spanish government soon was shifted to Manila (1571), but Cebu remained a stronghold of Spanish economic interests and prestige. The famous "Manila Galleons" made occasional stops at Cebu, enroute to or from Acapulco. Privately owned and governmental vessels made periodic trips between Manila and Cebu, tying together the two centers of Spanish culture and administration.

Spanish suzerainty provided relative stability under which the island and port of Cebu developed, largely through her militant opposition to Moro (Moslem) depredations. With the opening

FIG. 3. Aerial view of the port of Cebu. Foreign ships use the pierage; interisland ships use the marginal wharfage.

of the Philippines to world trade, areas on Cebu and on neighboring islands began commercial productions of export crops. Sugar and abacá flowed into the port of Cebu where it was transhipped onto foreign vessels for overseas shipment. Copra was added to the export list in the American era. The outcome of Spanish and American efforts aimed at drawing the Philippines increasingly into world trade was to funnel interisland movements of commodities destined for export into the "open ports." Cebu began to function actively as a collecting and transhipping port.

Economic Factors

The collecting and transhipping role which Cebu now plays in interisland commerce can be partially attributed to an outgrowth of economic-social conditions present on the island. The rather unfavorable agricultural environment of Cebu cannot support the large number of people living on the island. Excluding the essentially urban population of the city of Cebu (1948: 167,000), there is a population density of approximately 2000 persons per square mile of rather poor cultivated land. Limited level land, excessively-drained coralline limestone soils, together with generally low rainfall (40 to 60 inches) have made it difficult or impossible to support Cebu's population from within the island. Insufficient food supplies and the need for outside income with which to purchase additional food supplies encourage the Cebuanos to capitalize on their site and strategic location.

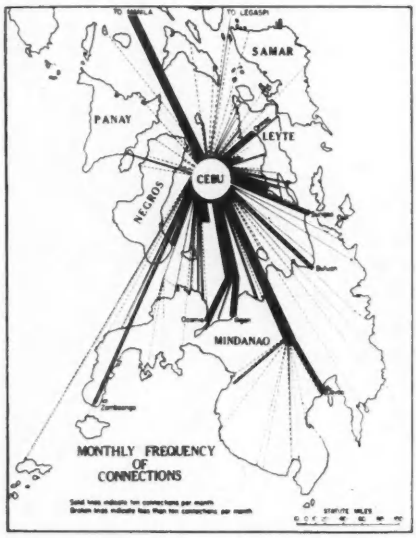


FIG. 4. Frequency of round-trip connections of the port of Cebu.

Warehousing, sorting and grading, collecting and distributing, and, above all, transhipping functions provide supplementary income.

In response to or strongly influenced by the foregoing factors, Cebu has become the most important Philippine interisland port, surpassing all ports in total numbers and tonnages of vessels entering, amounts of corn and copra landed, and total inbound and outbound passenger traffic. Scheduled and nonscheduled ships connect Cebu with all important ports in the eastern and central Visayan Islands and in Mindanao (Table I and Fig. 4).

Interisland Trade Patterns

The patterns of trade of the port of Cebu form three main streams. The most important movement involves the inbound shipments of interisland commodities. This stream consists of two major categories of cargoes: inbound food commodities for consumption on the island, and inbound cargoes destined for transhipment at Cebu for overseas markets. The second stream is provided by those shipments outbound from Cebu for ports within Cebu's trade area. The outbound interisland cargoes mainly consist of manufactured goods of foreign origin. The third flow of goods consists of foreign imports and exports.

Inbound Interisland Trade (Food Commodities)

Inbound food shipments are intended to supplement the inadequate subsistence food production on the island of Cebu. Corn, and, to a lesser extent, rice, are the most important inbound food commodities.

Approximately 150,000 tons of shelled corn annually move into Cebu, an amount of corn representing two times the annual production of corn on the island. Inbound corn shipments are relatively constant throughout the year, except for the period April through June which is corn planting season on the island of Cebu. During this period monthly corn shipments are doubled, totalling 18,000 tons monthly. Mindanao with its expanses of good agricultural land and relatively sparse population supplies most of Cebu's corn (Figs. 5 and 6). Cotabato and Dadiangas, with their large agricultural settlement projects, and Davao, with its year-round rainfall and ability to produce two or three crops of corn within

TABLE I

INBOUND INTERISLAND SHIPPING AT THE PORT OF CEBU, 1953–1954

Month	*Number of Entering Vessels*	*Gross Tonnage*	*Cargo Landed (tons)*
October	777	337,000	71,000
January	738	328,000	71,000
May–June*	828	345,000	78,000

*A split month, May 15–June 15, was chosen to consider trade patterns during the height of the drought period.

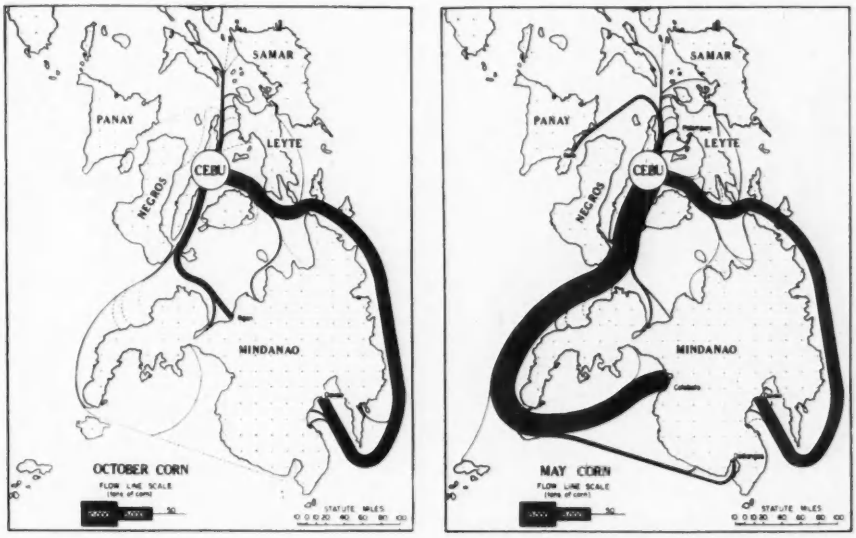


FIG. 5 (left). Flow of corn (in tons) inbound to Cebu during month of October, 1953.
FIG. 6 (right). Flow of corn (in tons) inbound to Cebu during month of May, 1954.

the space of one year, supply over 60 per cent of the corn. Iligan and Cagayan supply important quantities of corn from northern Mindanao.

Rice does not play as important a role in the diet of the Cebuanos as corn. Although local production is only 6000 tons annually, inbound rice shipments amount to less than one-quarter those of corn (35,000 tons). Inbound rice shipments show greater seasonal variations than corn, closely reflecting the availability of seasonal surpluses in the various producing areas. October rice shipments, when rice is relatively plentiful throughout the islands, are double those received during the main planting months of April through June. Similarly, January shipments are large, reflecting the harvest of the *palagad* or second crop of lowland rice. Rice trade patterns have similarities with corn in that the relatively empty, but productive, lands of Mindanao are more important than other areas, supplying 48 per cent of Cebu's rice. However, Iloilo, Ormoc, and Manila rank high during certain seasons. Surpluses in the Manila and Iloilo areas occur in the period September to November. Personal preferences and cost are important factors in the dominance of corn over rice.

The remainder of Cebu's inbound food commodities is comprised of a wide variety of Philippine-produced products—livestock, poultry products, fish, various fruits and vegetables, salt, and numerous others. Only livestock shipments are sufficiently large to warrant individual consideration (1400 head, monthly). The greater portion of the livestock are swine, originating from ports on the island of Leyte. Inbound livestock shipments are relatively small, owing to the fact that hog-rearing is a significant secondary occupation on Cebu, and Cebu is an important supplier of swine for the urban markets of Manila (20,000 head annually).

Inbound Interisland Trade (Export Commodities)

Inbound interisland cargoes intended for transhipment at Cebu to overseas vessels far exceed in tonnage and value the inbound food cargoes destined for local consumption. While abacá (Manila hemp) and lumber are represented in significant quantities, they are completely eclipsed by the large movement of copra and other coconut products. Cebu is primarily a copra port.[3] Supplies of coconut and copra are brought into Cebu from producing areas in the eastern and central Visayas and from Mindanao (Fig. 7). Coconut received at Cebu is transhipped as copra or processed into dessicated coconut or coconut oil and copra cake (the residual pressings from the oil extractive process).

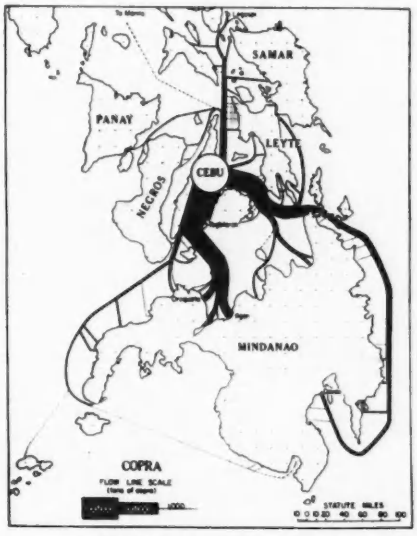
The emergence of Cebu as the Philippines' premier copra port is largely the result of its central location to producing areas and its reputation for quality copra. Copra and copra products move into Cebu chiefly from northern Mindanao and nearby Bohol Island, ports for which Cebu provides the closest "open port." The drier climatic conditions found in the Cebu area are responsible for the production of a superior quality sun-dried copra. "Cebu sun-dried copra" is a mark of quality within a generally poor quality copra area. The factor of superior quality made Cebu an important port-of-call for overseas vessels, in turn stimulating Cebu's copra collection function.

Copra shipments into Cebu show little seasonal fluctuation. Approximately 40,000 tons of copra enter monthly, and copra contributes over one-half of the total inbound interisland cargo tonnage.

Cebu does not rank high among Philippine ports in its receipts of abacá and lumber. Approximately 300,000 bales (35,000 tons) of abacá are landed from interisland vessels annually. A somewhat smaller quantity is eventually exported, the residue remaining on Cebu for local consumption. Cebu's abacá supplies come about equally from Mindanao and Leyte. The small ports of Baybay and Ormoc in western Leyte and the port of Surigao in northern Mindanao are the more important abacá sources for Cebu. Cebu is the closest "open port" to the western Leyte towns and the most convenient "open port," in terms of regularly scheduled shipping routes, for the port of Surigao. The principal abacá producing regions of the Philippines, i.e., southeastern Luzon and Davao Gulf, lie at some distance from Cebu and ship the bulk of their abacá through the open ports of Manila and Davao.

Difficulty in handling most Philippine woods precludes transhipment in quantity. Generally, Philippine logs and lumber are exported directly from the ports nearest the dozens of logging operations scattered throughout the archipelago. Approximately 33,000,000 board feet of timber products are carried to Cebu annually, an amount equal to 3 per cent of the total Philippine production. Only a small portion of the incoming interisland timber is intended for transhipment at Cebu to overseas vessels. The major portion of the timber is consumed on the island. Movements of inbound timber products show small monthly fluctuations. The port of Butuan on northern Mindanao is the chief source of timber for Cebu (40 per cent) with smaller shipments arriving from other logging operations in northern Mindanao and southern Negros.

[3] During 1953 Cebu shipped approximately 40 per cent of the total Philippine copra export. Manila ranked second as a copra port with 27 per cent. The remainder of the 1953 copra crop was exported from dozens of small ports scattered throughout the central and southern areas.



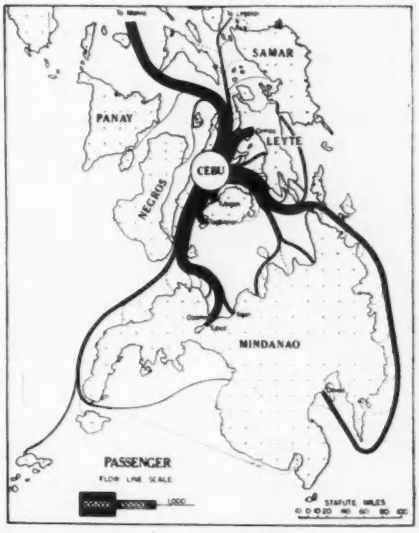


FIG. 7 (left). Flow of copra (in tons) inbound to Cebu, for the year 1953–54.
FIG. 8 (right). Flow of passengers to Cebu for the year 1953–54.

Inbound food and exportable commodities furnish Cebu with the bulk of her interisland trade. The remainder of Cebu's inbound interisland trade is comprised of a multitude of various items, collectively termed "miscellaneous cargoes." The greater share of these miscellaneous cargoes are manufactured goods of foreign origin, e.g., canned foods, textiles, metals and manufactures, and petroleum products. Since most Philippine imports are discharged at Manila, the bulk of Cebu's inbound miscellaneous cargoes come from that port. Cebu, in turn, redistributes these commodities to those ports within its trade area.

Outbound Interisland Trade

The outbound interisland cargoes from Cebu consist mainly of manufactured goods, normally of foreign origin. Cebu acts as the distributing center for the central and eastern Visayan islands and for northern Mindanao. Many Filipino firms have established branch offices at Cebu to service the trade area of approximately five million people living on the islands of Negros, Cebu, Masbate, Bohol, Leyte, western Samar, and northern Mindanao. Cebu often serves these areas as their only outside contact point.

Passenger Movements

Movements of passengers in and out of the port of Cebu are quite large, especially in view of the fact that there are no areas near enough to constitute a commuting passenger source. Cebu's passenger influx is greater than at any other Philippine port, rather clearly reflecting local economic conditions and, at the same time, the importance of her central position with respect to the northern and southern Philippines. Approximately 250,000 passengers disembark and a similar number embark at Cebu annually, 50 per cent more than land or load at Manila, the Philippines'

second passenger port. The greatest passenger flow is between the two ports of Cebu and Manila (14 per cent), a route connecting the nation's two largest cities. Ports on the island of Mindanao provide Cebu with approximately 36 per cent of the total inbound and outbound passenger traffic, particularly those ports located on Mindanao's northern coast. Leyte Island also bulks large in Cebu's passenger traffic, with the port of Ormoc ranking second to Manila (10 per cent) as a port of origin and destination (Fig. 8).

The large passenger movements of the port of Cebu appear to have arisen from several factors. Many Cebuanos have left Cebu to pioneer agricultural areas on Mindanao and to supply labor for the abacá plantations in Davao. Others have found more favorable economic conditions in northern Mindanao, on Leyte or in Manila. Once a year every effort is made on the part of these emigrants to return to Cebu to attend town and *barrio* fiestas, or to visit relatives. Cebu's increasing importance as a commercial center for Mindanao and the Visayas has resulted in a stimulation of freight and passenger movements. Buyers come from outlying islands within Cebu's trade hinterland, or commercial representatives from Cebu leave for field contacts. The concentration of educational institutions in Cebu also contributes to interisland traffic through large student movements.

EXPORT TRADE

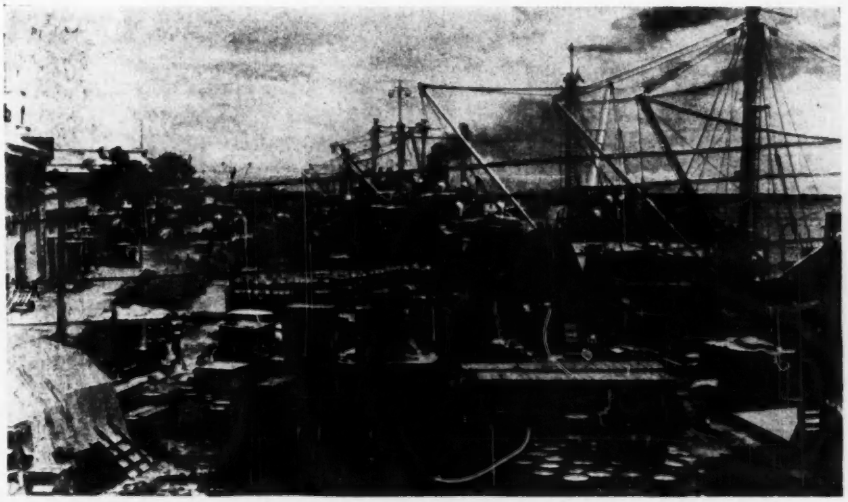
The third major flow of trade for the port of Cebu is supplied by her overseas connections. Cebu ranks a poor second to Manila as an international port although its status has improved in the postwar decade, and should continue to improve at the expense of Manila. A total of 410 ocean-going freighters called at Cebu during 1953 to discharge 650,000 tons of import and load 350,000 tons of export cargoes. Manufactured goods of European or United States origin dominate imports. Cebu consumes a part of these imports, reshipping the remainder to ports within the trade area.

Copra and coconut products lead exports from Cebu in value and tonnage. During 1953, Cebu shipped 232,000 tons of copra. The United States was the principal buyer (49 per cent) although countries in Europe and South America took important quantities. Cebu also made important shipments of other coconut products, including 25,000 tons of coconut oil (40 per cent of Philippine exports), 7800 tons of dessicated coconut (16 per cent), and 18,000 tons of copra cake (57 per cent). All of the coconut oil and copra cake went to the United States and most of the dessicated coconut, except for small shipments to Canada.

Abacá exports from Cebu amount to 25,000 tons, representing 20 per cent of Philippine abacá exports. Japan and the United States were the principal countries of destination, although western European nations took important quantities. Lumber exports left chiefly on Japanese vessels, largely because of their lower freight rate structure, destined for Japan or the United States. Most of the Cebu-produced sugar is exported to the United States, in accordance with existing Philippine–United States trade treaties with regard to Philippine sugar. Small quantities of "Class C" sugar are exported to Japan.

SUMMARY

The port of Cebu plays a key role in Philippine interisland trade and commerce. Largely because of its nodal geographical position, good harbor facilities, and commercially oriented popula-



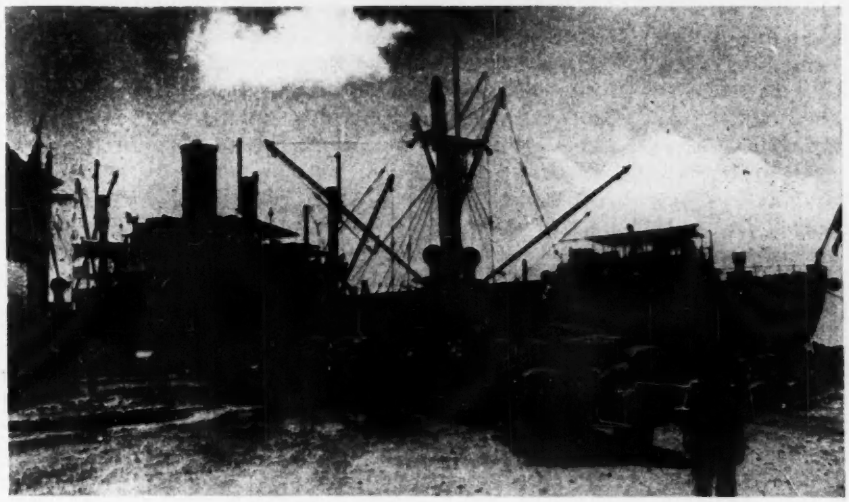


FIG. 9. Typical of the port of Cebu during busy periods. The lack of warehousing facilities forces storage in the open air. Both vessels in the foreground of the picture are serving in the interisland trade. (Courtesy of the Cebu Chamber of Commerce.)

FIG. 10. Loading copra on an overseas vessel at the port of Cebu. Each sack of copra weighs 220 pounds. (Courtesy of the Cebu Chamber of Commerce.)

tion, Cebu has developed into the leading interisland shipping and trade center of the nation. At the same time Cebu has become an important port-of-call for overseas vessels. Domestically produced food and exportable products move from the eastern and central Visayan Island and from Mindanao to Cebu for consumption or transhipment overseas. Corn and rice furnish the

TABLE II

EXPORTS FROM THE PORT OF CEBU, 1953

Copra and coconut products	282,000 tons	
Abacá	25,000	
Lumber	26,000	
Sugar	27,917	(U.S., Japan)
Chrome ore	6,562	(Japan)
Manganese ore	3,594	(U S., Japan)
Molasses	1,496	(Korea)
Tobacco	779	(Spain)
Shells	608	(U.S.)
Corn gluten	506	(U.S.)
Kapok	117	(Japan)
Hide cuttings	102	(Japan)
Rattan and products	62	(U.S.)
Iron ore	40	(U.S.)
Maguey	18	(Hongkong, Singapore)
Coal	7	(U.S.)
Crocodile and lizard skins	5	(U.S.)
Lard	1	(Hongkong)
Miscellaneous	143	
Total Export	374,957 tons	

bulk of the inbound food commodities; copra and coconut products comprise the bulk of products destined for overseas markets. Cebu is the principal copra port of the Philippines, exporting an amount equal to one-half of the total United States copra imports.

Foreign-origin products land directly at Cebu or arrive through transhipment at Manila for eventual distribution to population centers within Cebu's commercial hinterland. Cebu serves as the commercial center for eastern Negros, Cebu, Masbate, Bohol, Leyte, western Samar and northern Mindanao, and various smaller islands, an area serving approximately 25 per cent of the Filipino population.

In its functions the port of Cebu closely resembles a small edition of the port of Singapore, concerning itself primarily with handling, forwarding, reshipping, breaking-bulk, sorting, grading, processing, and distributing and collecting. Of course, in total amount of coastwise and foreign traffic handled it cannot compare with Singapore. Cebu's coastwise and overseas trade slightly exceeds that of the American port of Tacoma in volume.

THE IRON AND STEEL INDUSTRY IN CHINA

Muzaffer ErSelçuk

Mr. ErSelçuk is Associate Professor of Resources and Industries at Purdue University and is in charge of graduate work in the field of resource utilization. The iron and steel industry has been one of his chief research interests for a number of years.

COUNTRIES endowed with the resources necessary for an economical production of pig iron and steel, by developing such resources, stimulate the growth of related industries in both the fields of consumer and producer items. An ambitious program in industrial development for a country with a population of ten million or more cannot be carried out without the establishment of an iron and steel industry. It is essential, however, in order to develop an economic iron and steel industry, that there be adequate resources of iron ore, coking coal, limestone, and dolomite, as well as a domestic market which will absorb a minimum of about 200,000 tons of crude steel per year; that is, an iron and steel industry that would operate without much tariff protection.

The new masters of China, following the examples of their ideological comrades elsewhere, embarked on a large-scale development program in 1953. Thus, the so-called "Five Year Plan" was undertaken to increase Chinese ability to produce both civilian and military goods. In such a program steel's place is an obvious one.

Any analysis of China's iron and steel production suffers from a shortage of reliable data. Difficulties in obtaining information from China are partially responsible. A shortage of geological, technical, and statistical data in China, accompanied with questionable delivery dates of Russian equipment, contribute to a lack of knowledge on the subject. The situation is analogous to the putting together of a jigsaw puzzle with a number of pieces missing. Within these limitations an effort will be made to present a picture of China's iron and steel industry on the basis of known bits of information.

Raw Materials

The major raw materials of a steel industry are iron ore, coal, and scrap; but various other materials are needed.

Iron Ore

Iron ore reserves of China may be estimated at approximately 4338 million tons, containing 1537 million tons of metallic iron.[1] Of the total reserves of ore, 3189 million tons containing 1000 million tons of iron are in Manchuria (Fig. 1). Additional important iron ore deposits are found in Chahar (207.7 million tons of ore), Suiyuan (157.7 million tons), Hainan Island (107 million tons), and Hupeh (173.2 million tons). Of the total deposits only one-fifth may be classified as "economic ores."[2]

[1] The iron ore figures given are based on an unpublished manuscript of the writer covering 219 Chinese iron ore deposits. The estimate incorporates some of the recent discoveries.

[2] The term "economic ore" refers to ores that can be used in making pig iron at a cost equivalent to $60.00 or less per ton, provided a suitable supply of coke and limestone is present and equipment is available.

FIG. 1.

Intensive exploration during 1951–1954 has resulted in the discovery of new deposits in Suiyuan, Shansi, and Hupeh Provinces and on the Kiangsi-Hunan border area.

Coal

Coal is China's largest known mineral asset (Fig. 1). The reserve estimates vary. Among more recent figures, 240,847 million tons is given by Juan,[3] 265,311 million tons by the Geological Survey (1945), and 444,067 million tons by the National Resources Commission (1947). These figures are conservative and do not include the new discoveries made since 1947. But even with these conservative estimates China stands third in the world, ranking next to the United States and Russia in coal reserves.

Coal in China is predominantly anthracite and bituminous coal. Coking coal reserves amount to over 5 billion tons, an amount that is sufficient to

[3] V. C. Juan, quoting the figures of the Geological Survey estimate of 1939, in "Mineral Resources of China," *Econ. Geol.*, Vol. 41, No. 4, Part 2, Supplement, June–July, 1946, p. 414.

meet China's needs at the present rate of consumption for a thousand years. Two basic problems associated with the Chinese coking coals are (1) their location relative to the blast furnace centers, and (2) their quality. Although the distances between iron and coal deposits are not large by American standards, inadequacy of transportation systems in China makes transfer charges in bringing ore and coal together expensive. The quality of coking coals is generally good, except in their high ash content.

Chinese coal production, including Manchuria's contribution, increased from 24.3 million in 1925 to 35.8 million in 1935. During the Pacific War, in 1942, output rose to 65.1 million. Production fell to 14.0 million tons in 1946. Much work was done on coal mining under the Communist administration since 1949. In 1950 production reached 52.3 million tons; in 1951, 61.7 million tons; in 1952, 65.0 million; in 1953, 70.7 million; and approximately 80 million tons in 1954.

Scrap

One of the problems of China's steel industry is the lack of scrap to provide a suitable charge for open-hearths. Since China had been a small consumer of iron and steel in the past, the domestic supply of scrap is inadequate. Scrap shortage is remedied in two ways: (1) imports of scrap, (2) substitution of direct-iron and sponge-iron for scrap.

Through their agents in Hong Kong and Macao, the Chinese Government has purchased second-hand ships from the world ports. The demand for scrap was so keen that ships have been bought in such diverse regions as France, India, and New Zealand. These ships were broken up near Canton and scrap was sent by rail from Canton to the northern mills.[4]

Direct-iron and sponge-iron can be substituted for part of the scrap normally used in open-hearth furnaces. It has been found that up to 10 per cent of the charge may be composed of such substitutes without disturbing the efficiency of operation. Since the use of hot pig iron in the Chinese furnaces represents about 50–60 per cent of the charge, a 10 per cent sponge-iron addition would cut the need of scrap to 30–40 per cent, of which 20–30 per cent should be obtained from scrap of the plant's own arising. The amount to be purchased outside of the plant thus falls to about 10 per cent of the steel ingot production.

Direct-iron is produced in China by two methods, "native" and Krupp-Renn. In certain districts of Shansi, Shensi, and Szechwan the "native" method which is centuries old is still employed. Ore mixed with half of its weight in coal is placed in tube-like clay crucibles 4 feet long and 5 inches in diameter. About 250 of these cylinders are put upright in a kiln with coal packed around them. Three days of heating reduces the ore in the crucibles into iron pellets (on the top) and small blooms (at the bottom of the cylinder). The blooms are worked into wrought iron consumer objects. The pellets, once used for making cast iron, are now partly employed in steel making.

The Krupp-Renn Process is employed for treating low-grade ores in long rotary kilns. The process has advantages over the blast furnace in its ability to use low-grade ores and any kind of fuel. Its cost of operation, however, is much higher than that of the blast furnace per ton of product. Furthermore, the granules coming from the kilns are not uniform. The larger ones, one to two

[4] *Metal Bulletin* (London), February 9, 1951, No. 3566, pp. 19–20, reports that at least 6 tankers that had been in Hong Kong were towed to Whampoa (near Canton) between December, 1950, and January, 1951, and were converted into scrap.

inches in size, are relatively high grade; but the smaller ones, finer than 20 mesh, carry much adhering slag and have to be processed through the kiln a second time. Unless low-sulfur coal is used, direct-iron, because it contains sulfur, cannot be used directly in the open-hearth.

The Japanese built in Manchuria and China Proper at least 10 Krupp-Renn furnaces with an annual capacity of 140,000 tons. Their distribution was as follows:

Anshan—Manchuria	4 kilns	80,000 tons annual capacity
Fushun—Manchuria	2 kilns	20,000 tons annual capacity
Tangshan—Hopeh	2 kilns	20,000 tons annual capacity
Taiyuan—Shansi	2 kilns	20,000 tons annual capacity

Mechanical difficulties prevented these kilns from being operated at their rated capacity. The peak production in 1943 for Anshan was 18,000 tons and for Fushun, 8000 tons. The Russians removed part of the equipment of the rotary kilns in Manchuria during 1946. It is possible that they may have been rebuilt. The installations in Hopeh and Shansi are intact and presumed to be in operation. The Chinese Government has shown interest in the Krupp-Renn technique and research in this field is being conducted at Tsinghua University (Peking) under the direction of Professor Wang.[5] The Chinese probably are planning to use the cement kilns as Krupp-Renn furnaces in time of war when scrap shortage may become acute.

Sponge-iron is made in China by the Hoganas Process. Coal, limestone, and iron are put in saggers and heated in a special kiln and maintained at a temperature of 2100°F for 80 hours. The sponge-iron produced has about 96 per cent iron, 2 per cent oxygen and 2 per cent other elements. The Japanese built installations at Penchihu, Manchuria, which can produce 2000 tons of sponge-iron a year. The largest output of the plant was in 1942, when 1766 tons of sponge-iron was produced. The Russians did not remove any of the equipment during their occupation of Penchihu. If the plant is in operation, its production may be in part used by steel furnaces and the better quality material used for the making of iron powder.

Other Raw Materials

Limestone and dolomite, important ingredients used in the metallurgy of iron and steel, are found in large quantities in China. Manchurian reserves are particularly impressive.

Manganese is used in steel making. The amount necessary per ton of steel is about 14 pounds in the form of ferro-manganese. Manganese is also used in the making of ferro-alloys. China has ample reserves of manganese to meet the needs of her steel industry. An incomplete tabulation of manganese deposits in 1945 gave the total reserves at 29.4 million tons, averaging about 45 per cent manganese.[6] Some of the Japanese discoveries in China up to 1945 were not included in the reserve figure. Since the 1945 estimate the Chinese Communists have discovered new deposits. All the known important manganese deposits in China can be cheaply mined by the open-cut methods.[7] Moreover, the deposits are well located, being within rail or water transport reach of the existing and planned steel mills.

Ferro-alloy metals other than manganese are chrome, nickel, molybdenum, tungsten, and vanadium. Although the Japanese claimed discovery of chrome in Manchuria, no data exist on produc-

[5] *North China News Agency*, December 13, 1951.

[6] C. C. Pai: *Geologic Survey of China*, Special Report, No. 7, December, 1945.

[7] V. C. Juan: "Mineral Resources of China," *Econ. Geol.*, June–July, 1946, Vol. 41, No. 4, Part 2, Supplement, p. 435.

tion or size of deposits. Chinese chrome needs could be supplied from Indo-China. Nickel deposits so far are only known in Sikang Province. Low percentage of nickel (0.5 per cent), small size (320,000 tons), and poor location in respect to transportation facilities, make their exploitation only a remote possibility. China has adequate supplies of molybdenum. Deposits are found in Manchuria, Chekiang, Fukien, and Kwangtung. China has the world's richest and most extensive tungsten deposits. From 1934 to 1938 she supplied about 40 per cent of the world's tungsten. Vanadium is found in combination with iron in Jehol and is converted into ferro-vanadium.

Copper, tin, and zinc are commonly used as cover materials for steel. Their main products in combination with steel are copper-steel wire, tinplate, and galvanized sheets. All of the three metals are found in China in quantities substantial enough to meet her needs.

LOCATION OF PRODUCTION FACILITIES

It will be of interest to study a few of the known features of the leading iron works of China in respect to location, raw materials, and equipment, although no attempt will be made to give a technical description of production facilities. At the present time much of the Japanese-built equipment is being remodelled and generally improved. New blast furnaces and steel mills of Russian design are being planned and in some cases constructed in grass-root plants located at Huangshih, Maanshan, and Paotou.

ANSHAN IRON AND STEEL WORKS, SOUTH MANCHURIA

The most important metallurgical installations of China are located at Anshan, Manchuria (Fig. 2). Next to Kuznetsk in Siberia, Tata in India, and Yawata in Japan, the Anshan Iron and Steel Works are the largest iron smelting facilities in Asia. Anshan is about 200 miles by rail from Dairen, 150 miles from the Korean border, and almost 500 miles from the capital, Peking. From the point of raw materials, land transportation, and markets, Anshan is well located.

History

Very ambitious plans were made from time to time for the building of a large iron and steel center at Anshan. The original designs provided for blast furnaces with an annual capacity of 1,000,000 tons of pig iron and a similar amount of ingot steel production. In 1917, with the aid of an American engineering adviser, the Japanese started building two of the eight blast furnaces designed for a daily capacity of 250 tons. Due to a shortage of raw materials and water, only one of the two blast furnaces operated between 1919 and 1926. In 1920 pig iron production was only 31,620 tons or one-sixth of the capacity of the two furnaces. The pig iron produced contained 3 per cent silica, an amount that prevented the making of a satisfactory steel from it in the open-hearth furnaces of Japan where it was shipped. With the failure of the low grade ores in smelting, only the pockets of high grade ores were used for a while. Production increased to 75,283 tons in 1921 and to 88,241 by 1925. A great deal of money was spent for research and in 1923 a process of concentration for the "Anshan-type lean ores" was developed. In 1926 when the new concentrator was completed the second blast furnace was placed in service.

In 1930 a new, American-designed 500-ton-per-day blast furnace was built. A year later the Japanese invasion of Manchuria led to the preparation of several grandiose plans. By 1937 the

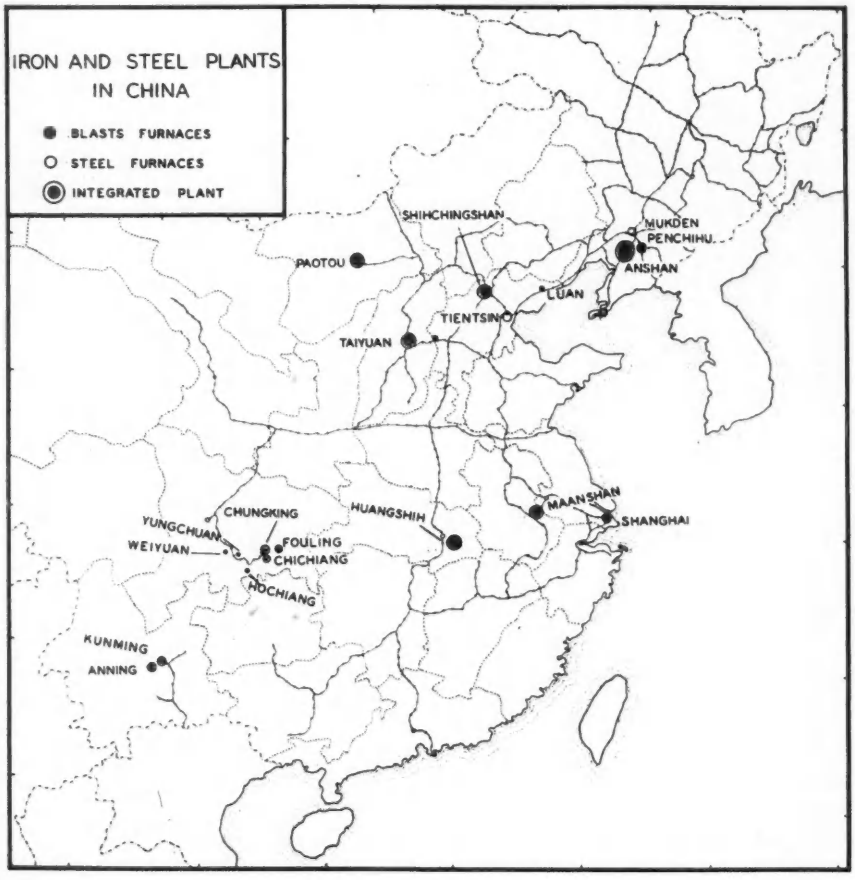


FIG. 2.

pig iron capacity was increased to 666,000 tons per year; for the first time open-hearth furnaces with capacities of 500,000 tons were added; and a new rolling mill was built. Between 1937 and 1943 five more blast furnaces came into existence, and the total pig iron capacity was raised to 1,926,000 tons; the target, to produce 3,060,000 tons of pig iron by 1943, however, was not attained. In 1943 Anshan produced 1,307,000 tons of pig iron or at 70 per cent of its designed capacity. A list of the equipment at Anshan in August, 1945 is given in Table I.

Anshan suffered minor casualties due to Allied bombing during the War. Blast furnaces Nos. 1, 2, 4, and 9 were partially damaged, but the rest of the equipment, with the exceptions of a few coke ovens, was in good shape when, in August 1945, the Russians occupied Manchuria. Southern Manchuria including Anshan was taken practically unopposed and with no damage to the steel mills. Upon their arrival, the

Soviets began a systematic and selective removal of industrial equipment; in a few months a once thriving steel center was reduced to an area filled with rubble, broken machines, and empty buildings. The Russians had removed 156,000 tons of equipment, thus reducing pig iron capacity by 75 per cent; steel ingot capacity, by 70 per cent; that of rolled steel, by 85 per cent. The Pauley Reparation Commission, after gathering all the data, concluded that in 1947 only one blast furnace was ready for production, this furnace being under repair at the time of the Soviet occupation. An American Consulate report from Shanghai on October 3, 1947, stated that only one open-hearth was producing and a second open-hearth was scheduled to be put into operation in December, 1947. The production of steel products was given at 3500 tons per month.

Anshan Under the Communists

With the establishment of the Communist Chinese sovereignty over Manchuria, Anshan once more became a humming industrial town. The Russian experts who had dismantled installations came back to rebuild them, following Russian blueprints, with equipment partly made in Russia and partly pro-

TABLE 1

ANSHAN IRON AND STEEL PLANT EQUIPMENT AND CAPACITY PRIOR TO PARTIAL DISMANTLING IN 1946

Plant	*Equipment*	*Construction date*	*Annual capacity in tons*
Pig Iron	*Blast Furnace:*		
	No. 1 400 t/day	1919	
	No. 2 400 t/day	1919	
	No. 3 550 t/day	1930	
	No. 4 600 t/day	1937	
	No. 5 700 t/day	1938	
	No. 6 700 t/day	1938	
	No. 7 700 t/day	1938	
	No. 8 700 t/day	1939	
	No. 9 700 t/day	1943	
	Blast Furnace Capacity		1,926,000
Steel	*Open-Hearth:*		
	4...100 tons	1935	
	2...150 tons	1937	
	6...150 tons	1942	
	Mixing Furnaces:		
	3...300 tons	1935	
	4...300 tons	1942	
	Ingot Steel Capacity		1,330,000
Luppe	*Krupp-Renn Furnaces:*		
	4...20,000 tons yearly	1939	80,000
Dressing	*Magnetic Separators:*		
	1	1926	
	1	1935	
	1	1937	
	1	1939	
	Concentrate Capacity		1,260,000
Sintering			1,280,000
Briquetting			400,000
Coking	*Batteries Ovens:*		
	5...216 Koppers	1919	
	3...108 Otto	1919	
	5...178 Otto	1935	
	7...252 Otto	1938	
	Total Coke Capacity		2,075,000

Source: Joseph F. Harrington and Benjamin M. Page: "Sources of Iron Ore in Asia," *Mineral Trade Notes*, Special Supplement No. 38 (to Vol. 34, No. 5), May, 1952, p. 146; with minor corrections.

duced in China. Facilities that once bore the trade marks of American, German, and Japanese engineers were remade to conform to Russian metallurgical practices. Keeping in mind the propaganda and prestige value of a Russian-built and Russian-directed iron and steel center in a land that contains one-fourth of the world's population, the Russian Government apparently did not hesitate to supply the best of what it could produce in the metallurgical line, nor did it fail to employ some of the better engineers in the redesigning and the reconstructing of the Anshan Center.[8] The equipment imported from Russia was paid for by money arranged under the 1950 loan of $300 million to China and the 1954 loan of $130 million (520 million rubles).[9]

After the Communist Chinese occupation of Anshan, the Chinese Government made the reconstruction of Anshan its prime industrial project with the highest priority. Late in 1950 two furnaces were in full operation and the plant was in a position to export pig iron to Japan. Undoubtedly most of the work during the first four years of the Communist Regime was in the form of repairs on the old equipment. In this period, however, plans were made for the construction and reconstruction of a fully integrated iron and steel plant. Major construction started in 1952. Every engineering enterprise in China was mobilized to supply Anshan with machinery and construction materials.[10] Chinese newspaper articles and radio reports told the public that magnetic concentrators and heavy crushers were made at Mukden, and parts of coking ovens were manufactured at Taiyuan. No doubt the old military arsenals located in these two towns, having missed most of the ravages of war in a relative sense, were the best qualified plants in China for the production of industrial equipment.[11]

The tempo of building increased in 1953. Equipment from Moscow, Leningrad, Sverdlovsk, and other Russian centers started to arrive. No. 8 blast furnace was blown in on March 8. On December 22 three Russian-built units, a blast furnace (No. 7), a continuous rolling mill, and a seamless tubing mill were placed in service with much publicity. The operation of these new plants was entrusted in part to Russian-trained Chinese engineers. Hastily organized technical courses at Anshan provided some assistance in training personnel. In 1952 about 5000 and in 1953 almost 7500 persons completed the short courses. A spare-time industrial university and two spare-time high schools were organized by the Anshan Iron and Steel Works in 1952. The next year, a 5-year program for the training of 5000 technicians in 90 different skills was adopted. One-half of the new technicians to be trained were

[8] *Peking Radio* on December 26, 1953, reported that the Soviet Government has given China assistance ranging from collecting basic data for designing, determining the outline of the working plan, installing equipment, and starting operations, up to trial production and the supply of technical specifications for turning out finished products.

[9] According to a *Pravda* article, October 13, 1954, Russia will provide a 520 million ruble loan to the Chinese in the form of equipment and technical aid in the building of 15 industrial enterprises and an increase in the amount of machinery which is being supplied to 141 enterprises that are being built under the 1950 agreement. The 1950 agreement had stipulated that the $300 million given to China should be in five installments of $60 million each for the years 1951–1954. It appears that the 1954 loan will provide $65 million annually for 1955 and 1956.

[10] A radio report from Peking on March 25, 1953, says 107 plants were supplying Anshan with equipment and material.

[11] Taiyuan arsenal fell into Communist hands in good shape. The Mukden arsenal on the other hand had suffered from the Russian occupation. The new section which was equipped with modern tools lost everything, whereas in the old section only one-third of the equipment was taken, all the antiquated machine tools being left intact. Chinese, clever in fixing old equipment, put these into operation.

to be chosen from among the existing workers of Anshan.[12] Furthermore, 30,000 workers were to be given some on-the-job instruction between 1953 and 1956. In October, 1954, Anshan had 50,000 workers,[13] of whom about 10 per cent were women.[14] The existence of such an immense force indicates that, in spite of the new automatic heavy equipment, the labor efficiency still must be very low.

While production per worker is low, the performance of some of the equipment has exceeded what it was under Japanese rule. This is especially true of the blast furnaces where a few skilled workers under Russian direction could operate large units. The Chief Engineer of the Anshan Iron and Steel Company told the delegates of the National People's Congress in Peking on September 8, 1954, that Anshan was operating five blast furnaces and producing pig iron at the rate of 1,500,000 tons a year. This is about 200,000 tons more than the output of nine blast furnaces operated by the Japanese in 1943 when 1,307,000 tons of pig iron were produced (see Table II and Fig. 3).

Raw Materials for Anshan

The raw material requirements for the Anshan blast furnaces present a number of problems. A casual glance at a resource map of Manchuria may give the impression that Anshan is well located with respect to both coal and iron ore resources, but a detailed investigation would reveal that such is not the case. The large coal deposits near Anshan do not provide metallurgical coke and the immense iron ore reserves contain mostly lean ores.

[12] *Peking Radio*, January 5, 1953.
[13] *Peking Radio*, October 3, 1954.
[14] According to *China Reconstructs*, No. 2, 1953, p. 4, there were in 1953 over 3700 women workers at Anshan Iron and Steel Co., of whom more than 200 were being trained as welders.

When the first blast furnace was built in 1919, plans were made to use coal from the nearby Fushun deposits. It was soon discovered the Fushun coal did not produce a satisfactory metallurgical coke. During the early 1930's an 80 per cent Fushun, 20 per cent Penchihu and Kailan mix was used for coke making. One basic disadvantage of Fushun coal is that, once it is allowed to stand for any length of time after mining, it will not coke even if mixed with a good coking coal. At present Anshan gets its coking coal from Kailan mines in North China, Peipiao in Jehol, and Mishan and Haokang, North Manchuria. These coals are transported to Anshan by rail, traveling distances varying between 150 miles (Peipiao) and 800 miles (Haokang). Fuel coal comes from Fuhsin and Fushun. Since 1950 the supply of coking and fuel coals have become adequate.

Iron ores used by the Anshan furnaces come mostly from three sources: Hsuanhua in South Chahar, Tungpientao near the Korean border, and Anshan-Kungchangling. Of these, the Hsuanhua and the Tungpientao ores are rich in iron. The Anshan-Kungchangling areas contain mostly lean ores with occasional pockets of rich ores.

In the Anshan-Kungchangling Area, hematite is the predominating iron mined on the surface. Out of 14 mines, 12 produce hematite and two, magnetite. At depth, the ore changes from hematite to magnetite. The iron content of the lean ores varies from 24 per cent to 45 per cent. Sulfur and phosphorous are low and the total amount of oxides of aluminum, magnesium, and calcium jointly seldom exceed 5 per cent. Most of the ores have manganese, but not exceeding 1 per cent. The main impurity is silica, averaging 40 per cent. The lean ores in the Anshan-Kungchangling Area, including Papanling, in 1954 made up

TABLE II

PRODUCTION OF COKE, PIG IRON, LUPPE AND OPEN-HEARTH STEEL AND IRON ORE AT ANSHAN
(in metric tons)

Year	*Coke*	*Pig Iron*	*Luppe*	*Steel Ingot*	*Rich Ore*	*Lean Ore*	*Total*
1932	304,000	300,000	‡	‡	†	†	†
1933	307,000	312,000	‡	‡	†	†	†
1934	357,000	347,000	‡	‡	†	†	†
1935	480,000	472,000	‡	147,000	†	†	†
1936	540,000	492,000	‡	344,000	†	†	†
1937	718,000	677,000	‡	451,000	†	†	†
1938	876,000	713,000	‡	622,000	†	†	†
1939	1,140,000	880,000	‡	562,000	†	†	†
1940	1,155,000	939,000	13,000	554,000	846,000	1,619,000	2,465,000
1941	1,452,000	1,192,000	17,000	573,000	1,117,000	2,034,000	3,151,000
1942	1,575,000	1,309,000	19,000	724,000	1,146,000	1,943,000	3,089,000
1943	1,644,000	1,307,000	18,000	837,000	1,232,000	1,893,000	3,125,000
1944	1,129,000	862,000	20,000	437,000	1,264,000	514,000	1,778,000
1945	†	†	†	†	†	†	†
1946	†	†	†	†	†	†	†
1947	†	†	†	†	†	†	†
1948	†	†	†	†	†	†	†
1949	†	175,000e	†	150,000e	†	†	†
1950	†	400,000e	†	550,000e	†	†	†
1951	†	600,000e	†	750,000e	†	†	†
1952	†	700,000e	†	1,000,000e	†	†	†
1953	†	900,000e	†	1,200,000e	†	†	†
1954	†	1,450,000e	†	1,400,000e	†	†	†

Compiled from various sources. The abbreviation "e" stands for estimate, "†" for no data available, "‡" for no production.

98.5 per cent of the total deposits of 2,115.9 million tons. The rich ores amounted to only 24.4 million tons. Almost all of the lean ore is open-pit mined. Some rich ores are extracted by underground mining methods and certain amounts of lean ores are also extracted in connection with the rich ores. Lean surface ores are hard, and were blasted by the Japanese through the use of liquid oxygen and carbon black. The mined ore is crushed and screened at the dressing plant located near the mine. The ore is classified by size, lump ore being separated from the fine ore. The sorted ore is loaded from the bins into railroad cars and carried to Anshan. A loop railroad with branches connects the 11 mines to Anshan and another 50-mile railroad provides the connection with the three mines of Kungchangling.

The lean hematite of Anshan-Kungchangling could not be concentrated by the conventional means of beneficiation and a special method had to be developed. The ores are mostly hematite and lack magnetic qualities. Therefore, they have to be converted into magnetite. This is accomplished in special bell top-fed furnaces about 30 feet in height. About 55 pounds of coal and 1350 cubic feet of coke oven gas are necessary for roasting each ton of ore at 650°C. The ore, while being converted into magnetite from hematite, becomes brittle in the furnaces and easy to crush. The magnetized ores

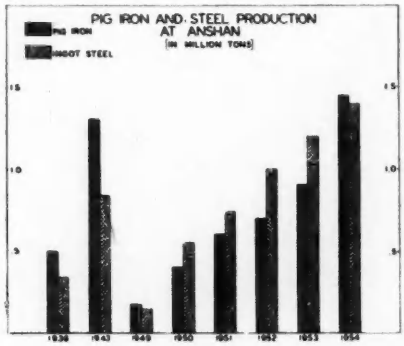


FIG. 3.

are pulverized by ball mills first, and then ground by tube mills to a powder as fine as talc. Electro magnets then separate iron from rock, although some silica still clings to the iron particles. The product is sintered by the Dwight-Lloyd machines or briquetted. In 1938 the annual sintering capacity of the plant was 1,100,000 ore-tons.[15] The capacity in 1945 was estimated by the Pauley Commission at 1,280,000 tons per year. The largest amount sintered was in 1942 when 822,000 tons were made. Under the Japanese the sinter charge was composed of 80 per cent concentrates, 10 per cent coal, 6 per cent limestone, and 4 per cent flue dust. Briquetting was done in a plant of 400,000 tons annual capacity, though the largest production was only 155,000 tons (in 1943). A new technique of agglomeration (pelletizing) is used by the Chinese where sintering is difficult.[16]

The Chinese appear to be doing some experimental work with the floatation process[17] and a caustic soda process,[18] in order to replace the costly Anshan Process described above.

It takes 2 to 2.5 tons of ore to prepare 1 ton of sinter. Although the equipment was designed to make 62 per cent iron-containing sinter, in actual practice up to 1945, the average iron content was 55 per cent. Furthermore, about 25 per cent of the iron in the ore was lost during the beneficiation process. There are indications that through more careful ore dressing the Chinese with the assistance of their Russian engineers have pushed the sinter iron content above 60 per cent. In the case of pellets, the iron content probably reaches 63 per cent to 64 per cent.

The efficient open-cut mining of the ore gives an iron ore of low cost, but the pre-blast furnace ore treatment raises the price of the iron charge. The cost of a ton of concentrate at Anshan probably is between the equivalents of $13.00 to $13.50 per ton. This price is several dollars higher than the prevailing price for 60 per cent iron ore in the world markets.

Anshan plants get their limestone from the quarry at Changtaitzu, about 35 miles northeast of the blast furnaces. Dolomite is obtained from Niuhsinshan.

Capacity and Production

At present there are five blast furnaces in operation at Anshan. Two more furnaces probably will be rebuilt during 1955. When these are completed, the plant will have two 600-ton and five 700-ton furnaces. The productive efficiency rate of a blast furnace is intimately connected with both the chemical and physical properties of the material charged into it. Ideally, the ore, limestone, and coke which comprise the furnace burden should be within the size range of 1 to 3 inches. Under the Japanese management it used to take on the average 1.75 tons of sinter, 0.025 ton of scrap, 1.0 ton of coke, 0.8 ton of limestone per ton of pig iron produced if only sinter was used. Actually, a charge composed of 0.7 ton of sinter, 1.3 tons of lump ore, and 1.2 tons of coke, 0.1 ton of open-hearth slag, and 0.6 ton of flux was a common practice. The Chinese, making use of their large manpower resources and relatively simple Chinese produced equipment, provide the furnaces with well prepared burdens by sizing the ore,

[15] "Special Concentration Process at Showa Steel Works, Anshan," *Contemporary Manchuria*, January, 1938, pp. 61 ff.

[16] *Peking Radio*, November 4, 1953.

[17] Finely crushed iron ore is agitated in water containing oil and chemicals. Iron is carried to the surface by air bubbles and oil, and forms a scum. This scum is dried and sintered to form a blast furnace material.

[18] In the treatment of high-silica iron by caustic soda, silica and sodium combine, leaving iron free from silica. Caustic soda recovered from sodium silicate solution may be used over and over again.

coke, and limestone to improve the flow of gas in the furnace. In addition through the improvement of the sinter quality and the introduction of pellets, the Chinese were able to cut the consumption of coke and limestone per ton of pig iron produced. The 700-ton-per-day furnaces, originally designed for an average charge of 50 per cent iron ore and sinter combined, are now producing as much as 20 per cent over their capacity. This fact, supplemented by possible improvements in blast furnace operating techniques, explains how the Chinese were able to operate the five furnaces at an annual rate of 1,500,000 tons of pig iron in September, 1954.[19] Shortage of capital and productive facilities and the relative ease in building ore dressing and concentration equipment are factors responsible for the mentioned intensive utilization of blast furnace equipment.

Production for 1954 may be estimated at 1,450,000 tons of pig iron and 1,400,000 tons of ingot steel.

Cost of Production

The transport necessary to carry coal, iron ore, and limestone for the production of a ton of pig iron has been estimated to be as low as 382 ton-miles for Anshan.[20] This figure appears over-optimistic and probably is based on the assumption that Fushun coals will be used for coking. Although an accurate estimate is not possible to make, on the basis of fragmentary data, the transportation requirement for raw material assembly may be calculated to be around 700 ton-miles. Compared with Pittsburgh which has a total of about 1100 ton-miles, Anshan is in a better position but its transportation requirement is higher than either the Russian plant at Kuznetsk or the Tata plant at Jamshedpur in India. Furthermore, the problem of lean ores increases the expense of making a ton of pig iron at Anshan relative to the world's major ferrous smelting centers. Cost of production at Anshan appears to be a little higher than Pittsburgh and much above both Kuznetsk and Jamshedpur.[21]

PENCHIHU, SOUTH MANCHURIA

Penchihu is the second blast furnace center in Manchuria, and is located on the Mukden-Antung Railroad. The plant's history goes back to 1911 when the Okura interest of Japan formed a Sino-Japanese joint venture. The plan of the company was to build eight blast furnaces and a steel plant. The first blast furnace commenced operations in January, 1915. It had a capacity of 150 tons per day.[22] A similar furnace was completed in 1918. During the 1916–1918 war boom two small 20-ton furnaces were constructed. However, after the war, they were discarded.

In 1926 only 51,000 tons of pig iron were made. Production increased slowly and in 1931 it had reached 66,000 tons or about 50 per cent of capacity. With the rebuilding of the furnaces, output climbed to 153,357 tons in 1934.

In 1939, the company operating Penchihu was reorganized and with the

[19] *Peking Radio*, September 9, 1954.

[20] United Nations Department of Economic Affairs, *World Iron Ore Resources and Their Utilization*, Lake Success, New York, 1950, pp. 32–33.

[21] Although the cost of assembly at Pittsburgh in terms of ton-miles is much higher than Anshan, the cost of transfer per ton-mile is lower in the United States than in Manchuria due to a more efficient railroad system, automatic loading and unloading and the fact that water transportation, which forms a part of the 1100 ton-miles, is cheaper than land transportation.

[22] C. F. Wang: "Coal and Iron Deposits of the Penchihu District, Manchuria," *Transactions of the American Institute of Mining Engineers*, Vol. 59, 1918, pp. 305–423. The capacity of the same furnaces were given at 180 tons per day apiece in 1934 by Kumahiko Hasegawa: "On the Metal Industry of Manchukuo," *Memoirs of the Ryojun College of Engineering*, Inouye Commemoration Volume, Ryojun, 1934, pp. 104 ff.

aid of new capital two 600-ton furnaces were constructed at Kungyuan, two miles east of Penchihu, one in 1940 and the other in 1941. Although production with the aid of these furnaces increased to 208,427 tons in 1941, 306,675 tons in 1942, 403,300 tons in 1943, and 373,874 tons in 1944, a lack of repair parts for the iron ore dressing plant, a shortage of iron ore, and a temporary scarcity of coal resulting from an explosion at the Penchihu coal mine prevented full utilization of the plants. As of August 15, 1945, the plants at Penchihu and Kungyuan had a capacity of 574,000 tons of pig iron per year. In addition Penchihu had 2000 tons of sponge-iron and 7000 tons of electric steel capacity.[23] In 1947 the Pauley Reparation Commission reported that the two 200-ton furnaces were in good shape.

Raw Materials

Penchihu is located in the center of a rich iron area. About 16 miles south is the Miaoerhkou deposit, 22 miles southwest that of Papanling, 18 miles north that of Waitoushan, and 10 miles west those of Tahoyen and Paitaikou.

Miaoerhkou is the most important of the group. The mine is five miles east of Nanfeng Station on the Mukden-Antung Railroad. The deposit contains 7,500,000 tons of 64 per cent iron-bearing ore and 440,000,000 tons of lean ore with 32 per cent iron. Miaoerhkou ore differs from ores of mines around Anshan in the respect that it contains more magnetite and consequently can be easily concentrated magnetically.[24] This ore is also low in phosphorous, and the pig iron made from it is suitable for making special steels including armor plates. After mining, the ore is transported by rail to the dressing plant near Nanfeng. Concentrates from this plant are carried to Penchihu. The high-grade concentrate is briquetted and the low grade is sintered. The capacity of the briquetting plant in 1945 was rated at 400,000 tons and the sintering plant at 200,000 tons annually. In 1943, the largest production year, 438,101 tons of briquetted iron and 48,877 tons of sinter were produced. Miaoerhkou produced 373,000 tons of rich and 633,000 tons of lean ores in 1943, and 424,000 tons of high grade and 512,000 tons of low grade ores in 1944.[25] Of other deposits supplying Penchihu, Papanling provided 121,000 tons of rich ores in 1943 and 84,000 tons in 1944. Others supplied in 1944 about 88,000 tons, half of which was considered ore containing better than 50 per cent iron.

Coal for coking used at Penchihu to a large extent comes from the Penchihu coal field. This field covers an area of 9444 acres and contains 17 seams with an aggregate thickness of 550 feet. The total reserves are estimated to be around 225 million tons.[26] Penchihu coal is considered one of the best coking coals in China. Nevertheless, it has a medium high ash and sulfur content. Washed coal contains 8.72 per cent high aluminum and silica ash, and 0.7 per cent to 2.1 per cent sulfur.

The limestone is extracted from a quarry about a mile away from the Penchihu plant. It is transported to the limestone yard of the furnaces by a belt conveyor.

[23] Sponge-iron and electric-steel capacity is from H. G. Cordeo: *Iron and Steel Works of the World*, First Edition (1952), Quin Press, London, p. 403.

[24] Joseph F. Harrington and Benjamin M. Page: "Sources of Iron Ore in Asia," *Mineral Trade Notes*, May, 1952, Special Supplement No. 38 (to Vol. 34, No. 5), p. 156.

[25] Theodore N. Johnston: "Iron and Steel Metallurgy of the Japanese Empire," *Natural Resources Section Report No. 50*, General Headquarters Supreme Commander for the Allied Powers, Tokyo, 1946.

[26] United Nations, Economic Commission for Asia and the Far East: *Coal and Iron Ore Resources of Asia and the Far East*, July, 1952, Bangkok, p. 48.

Penchihu is connected to the Yalu River hydroelectric power plant by a transmission line and therefore has access to low cost electricity. It also has a steam generating power unit.

Production

Penchihu occupies a most convenient position for the gathering of materials needed in the manufacture of pig iron. Its position is comparable to that of Birmingham, Alabama. The transport necessary to carry coal, iron ore, and limestone for the production of a ton of pig iron may be calculated to be less than 50-ton miles for Penchihu, one of the lowest in the world.

The cost of production of a ton of pig iron at Penchihu may be computed to be $22.00 to $24.00 if the plant operates near capacity without any breakdowns. In its present operation the cost is probably much higher because of difficulties experienced with old equipment and lack of replacements. The Chinese press reports indicate that at times production has fallen behind the target and the amount of poor quality pig iron produced has been as high as 45 per cent of the total output. The high-alumina ash in the coke makes slag high in alumina and as a result the slag is difficult to handle. This, accompanied with the problem of the sulfur, requires careful preparation of the blast furnace charge and accurate control of the operation. Only after the coming of the Russian experts did the blast furnaces begin to meet their production plans.[27] The present production of Penchihu may be estimated to be around 350,000 tons of pig iron per year. The ideal conditions for the assembly of raw materials and an easy access to the markets make the Penchihu Area a logical place for the creation of an iron and steel center. Perhaps the Chinese are waiting for the completion of the expansion at Anshan along with the delivery of equipment from Russia, promised under the Russo-Chinese agreement for October, 1954, before initiating any ambitious plans.

[27] *Peking Radio*, November 7, 1953.

SHIHCHINGSHAN IRON AND STEEL PLANT, HOPEH

The Shihchingshan Iron and Steel Works are located 11 miles west of Peking. The plant is connected by branch lines with both the Peking-Paotou (Suiyuan) and the Peking-Hankow trunk lines. The site is a good one, there being ample room on the great flat plain for expansion. Furthermore, the plant is located near extensive coal deposits and has an ideal place relative to the markets for pig iron and steel.

History

The first unit of the Shihchingshan Iron and Steel Works, a 250-ton blast furnace designed by Perin and Marshall of New York in 1920, was completed in 1922. Materials used in the construction were of American manufacture. In spite of its good design and construction, the furnace was not blown in when it was finished but remained idle until November, 1938, when the Japanese completed reconditioning the plant.

The Japanese moved a blast furnace of 380-tons-per-day capacity to Shihchingshan from Yawata, Japan, and put it into operation toward the end of 1941. A third unit, a furnace of 600 tons, was under construction when the Japanese left China in August, 1945. It was about 80 per cent complete. The Japanese also built 11 small 20-ton blast furnaces. Production of pig iron at Shihchingshan under Japanese control is given in Table III.

Once equipment from Russia becomes

TABLE III

PRODUCTION OF PIG IRON AT SHIHCHINGSHAN, 1938–1944
(in metric tons)

Year	*Large furnaces*	*Small furnaces*	*Total*
1938	10,762	.....	10,762
1939	32,296	.....	32,296
1940	32,615	.....	32,615
1941	21,713	.....	21,713
1942	36,458	.....	36,458
1943	32,787	12,760	45,547
1944	55,763	15,547	71,310

Source: Harrington and Page, *op. cit.*, p. 100.

available, it is most probable that the Chinese are planning to set up at Shihchingshan a fully integrated plant with a blast furnace capacity of about a million tons per year and a steel capacity of a similar amount.

Shihchingshan Under the Communists

Shihchingshan occupies a special place in the Chinese Communist planning (Table IV). Being close to the capital its operations are under continuous surveillance. Important foreign visitors to Peking are usually taken to see the Shihchingshan Works. The plant is also used in the training of workers for other iron and steel centers. Construction of 5000 new houses built under the Communist Regime gives a clue to the ambitious nature of plans for the future of Shihchingshan.

Raw Materials

Iron ore comes to Shihchingshan from the Lungyen Iron Mines located in the vicinity of Hsuanhua, Chahar. The deposits are scattered in six different areas, some easily accessible by rail, others located in rough terrain. The rail distance between the most distant Lungyen mine and Shihchingshan is about 130 miles. The iron reserves of the six deposits contain a minimum of 55.7 million tons with an average metal content of 50 per cent. The ore is hematite with low sulfur and phosphorus content. Although the ore is fairly soft it is strong enough to stand the burden in 700-ton furnaces and is readily fusible, but its slag volume is high because of 20 per cent silica. Most of the iron mined comes from underground workings.

Good coking coal is supplied to Shihchingshan from the Kailan mines, a distance of about 170 miles by rail. Kailan deposits contain about 690 million tons of coal. Steam coal is obtained from the anthracite mines of Mentoukou, a few miles west of Shihchingshan. Hills around Mentoukou also supply limestone.

The transport cost of raw material assembly for Shihchingshan is between 430 and 450 ton-miles per ton of pig iron produced.

The production of Shihchingshan for 1954 was probably about 400,000 tons of pig iron and 300,000 tons of ingot steel.

TIENTSIN STEEL MILL, HOPEH

Between 1940 and 1945 the Japanese built five small 20-ton blast furnaces at Tientsin, one 25-ton open-hearth, and one 1-ton electric furnace. The blast furnaces never proved satisfactory.

TABLE IV

A LIST OF SHIHCHINGSHAN IRON AND STEEL PLANT INSTALLATIONS, MARCH, 1955

Unit	*Capacity per day*	*Date of construction*
Blast Furnaces:		
No. 1.....	250 tons	1923
No. 2.....	380 tons	1941
No. 3.....	600 tons	1952
No. 4.....	600 tons	under construction
Steel Furnaces:		
No. 1.....	150 tons (?)	1952
No. 2.....	?	1953 (?)
Nos. 3 and 4.....	?	1954–1955 (?)
Coke Ovens:		
750.....	1,250 tons	1937
365.....	800 tons	1952
Coal Washer.....	3,000 tons	1952

Although a peak output of 130 tons was reached in August, 1944, the quality of pig iron was poor and it had to be used in castings only. The open-hearth and electric furnaces were supplied with pig iron from Shihchingshan. The pig iron output declined to 35 tons by August 1, 1945, when three of the five furnaces were being repaired. After the termination of Japanese occupation, the blast furnaces became idle.

In October, 1947, the open-hearth furnace was repaired and put into operation by the Chinese Nationalists. When the Communist armies occupied Tientsin, the plant fell into their hands undamaged. There was an expansion of steel making facilities between 1950 and 1954. Reports from Peking indicate that production of steel has been increased through the reduction of heat time for each batch.[28] The production of steel at Tientsin was probably about 50,000 tons during 1954.

LUAN (TANGSHAN), HOPEH

About 140 miles by rail from Tientsin, on the Peking-Tientsin-Mukden Railroad, the Japanese built during 1942 through 1944 ten small 20-ton furnaces at Luan (39°27′ : 118°11′). At Yaoshan (near Tangshan) west of Luan, the Japanese also installed two Krupp-Renn furnaces of 10,000-ton annual capacity each and two small electric steel furnaces. In 1945 the capacity of the blast furnaces was 73,000 tons per year. It was reported that the plant "came into operation again not very long after the end of the war."[29] The present status is uncertain.

Luan furnaces are ideally located with respect to raw materials. Iron, coal, and limestone are found in close proximity of the plant. The cost of assembly of raw materials is less than 40 ton-miles per ton of pig iron produced. Coal for coking is available from various Kailan deposits 10 to 30 miles west of Luan. Iron is found at Ssu-chia-ying (39°40′ : 118°40′), about eight miles from the Luan railroad station. The deposit contains 600,000 tons of 45 per cent iron-bearing ore, 4,500,000 tons of 30 per cent ore, and 20,000,000 tons of 26 per cent ore. Only the better ores were used by the Japanese. Since only a small amount of rich ore is available, Luan is not particularly suitable as a place for setting up a large iron and steel center.

PAOTOU, SUIYUAN

Paotou is located in central Suiyuan, a few miles from the Yellow River, 508 miles from Peking by rail. Suiyuan is a desolate part of China. For this reason the Communists would like to see the area developed. Paotou also has strategic importance in that it is about 650 miles, as the crow flies, from the Yellow Sea. Therefore, it has relative distance protection from planes flying from aircraft carriers.

From an economic point of view there is a certain amount of justification in creating a new iron and steel center at Paotou. Very large iron ore deposits of Paiyunpokdo are located about 100 miles to the north of Paotou. Japanese geologists investigated the region in 1940, but due to its distance from Japan it was not developed. In September, 1944, Lt. General Reikichi Tada, then the Director of the Scientific Mobilization Society (Japan), announced that the ore reserves were extensive.[30] Work during 1952 and 1953 by the Chinese geologists show that the reserves are much larger than assumed in the past.[31]

[28] *Peking Radio*, February 3, 1953.
[29] H. G. Cordeo: *op. cit.*, p. 403.
[30] *Domei Agency Report*, Tokyo, September 26, 1944.
[31] *North China News Agency*, Peking, January 13, 1954.

About 39 million tons of 60 per cent iron and 118 million tons of 36 per cent iron appear to be present in the area. The rich ores contain about 4.0 per cent and the poorer ores about 19.0 per cent calcium carbonate, and consequently are partially self fluxing. In addition to the Paiyunpokdo deposits there is also iron at Kungyiming about 40 miles north of Paotou. Here about 900,000 tons of 36 per cent iron-bearing ore is found.

Coal reserves of Suiyuan have not been studied in detail. Three deposits in the Anpei Area, about 60 miles northwest of Paotou, contain about 100 million tons of bituminous coal with some anthracite. Approximately 20 miles northeast of Paotou about 85 million tons of bituminous coal is found at Shikuai. Ninety miles to the east of Paotou are the coal reserves of the Kueisui District with 35 million tons of anthracite, 35 million tons of bituminous coal, and 15 million tons of lignite.[32] The coals of Suiyuan range from high-volatile lignite and bituminous coal to anthracite, the prevailing rank being low to medium-volatile bituminous coal. The coking characteristics of these coals as well as the quantity of their reserves require extensive studies. Realizing this situation, the Chinese have concentrated their efforts on finding good coking coal in the Tatung Coal Basin, about 280 miles from Paotou by rail. Here the presence of 20 to 40 billion tons of coal had been reported by Japanese geologists. Most of this coal is non-coking. The Chinese began large scale prospecting and drilling for coking coal in 1953.[33]

A new iron and steel center was under construction at Paotou during the latter part of 1954.[34] Production of iron and steel at a price corresponding to that of Anshan appears difficult until such a time as good coking coal supplies become available from Tatung coal mines or new discoveries are made of coking coal in Suiyuan.

[32] Shikuai and Kueisui reserve figures are based on a field study made by C. C. Sun in 1931, published under the title "Geology of Suiyuan and Southwest Chahar," *Geological Survey of China, Memoirs*, Series A, No. 12, 1934.

[33] *North China News Agency*, Peking, March 5, 1953.

[34] *Peking Radio*, November 2, 1954.

TAIYUAN, SHANSI

Taiyuan, the capital of Shansi Province, has a central location in the Province. It has four blast furnaces. One of these, a small 40-ton-per-day furnace, existed prior to the Japanese occupation. After a brief period of idleness it was placed into operation by the Japanese in November, 1939. A larger furnace of 120-ton-per-day capacity and by-product coking ovens, two 30-ton open-hearths, and a rolling mill of 45,000 ton capacity were placed in operation during 1940. Between 1941 and 1945 two more blast furnaces of 40 tons each, two Krupp-Renn furnaces with an annual capacity of 10,000 tons each, were added, and the open-hearth capacity was increased to 117,000 tons. All of these installations fell into the Communist hands with little or no damage.

Raw Materials

In central Shansi 20 million tons of iron ores are said to be present within the easy reach of Taiyuan. Although the total reserves for the Province had been estimated at 300 million in August, 1952, the deposits are mostly dispersed and deeply buried. Most of the ore is siderite with a certain amount of limonite and hematite. Without extensive exploration and railroad building, large scale utilization of the Shansi iron deposits is not possible. Shansi ores

require beneficiation before they could be used.

The area around Taiyuan is rich in coal deposits. Over a hundred billion tons of anthracite and bituminous coals lie within a 150-mile radius of Taiyuan.

Present Status

Taiyuan was chosen by the Chinese leaders to become one of the centers of heavy industry. Here, a large machine tool plant is being built. This factory, designed to produce equipment for rolling mills, by-product coking ovens, and metallurgical enterprises, is partially complete. The steel industry is also being expanded. As early as 1950 the Taiyuan plant surpassed the production peak reached under the Japanese rule.[35] The output of pig iron in 1954 was probably about 80,000 tons and that of steel about 200,000 tons.

PAOCHIN IRON WORKS AT YANGCHUAN, SHANSI

Paochin foundry had in August, 1945, one 30-ton, two 20-ton blast furnaces, and one 4-ton electric furnace. In 1944, production was 4000 tons of pig iron, less than one-sixth of the capacity of 25,000 tons. The plant used local ores and coal. The present status of the Paochin Works is not known.

SHANGHAI, KIANGSU

In 1950 Shanghai had 30 enterprises engaged in the production of iron and steel products. They fell into Communist hands almost intact and 23 of them were in operation in March, 1950.[36] Although the number of iron and steel enterprises is impressive, their capacities are small. Of the 30 plants only seven had steel melting facilities. All the pig iron and steel making installations were owned by one company which had, in 1950, two small blast furnaces (one 12-ton, one 33-ton), two open-hearth furnaces (one 30-ton, one 70-ton), and six electric furnaces (four 1-ton, one 1½-ton, and one 3-ton), and a small rolling mill that could produce bars, billets, structural shapes, and light rails. The total annual capacity of the listed units of this firm, the Shanghai Iron and Steel Company, was 16,200 tons of pig iron, 75,000 tons of open-hearth steel, 12,000 tons of electric steel, and about 12,000 tons of rolled products. At present these installations are being operated full time. Some difficulties were, and probably still are, being experienced with the quality of the open-hearth steel produced. In 1953 about 50 per cent of the ingot, being of low quality, was unacceptable to the rolling mill.[37]

MAANSHAN (TANGTU HSIEN), ANHUI PROVINCE

Maanshan is located a mile from Tangtu, Anhui Province. Near Maanshan the Nationalist Government of China intended to create an iron and steel center, plans for which were prepared during 1934 through 1936. The hostilities with Japan, starting in 1937, prevented the plans from being put into effect. In 1944 (through 1945), the Japanese began erecting 20 small blast furnaces; the war came to an end before the construction was completed.

Under the Communist rule the idea of building a large integrated center at Maanshan was revived. It appears one blast furnace of large size with modern auxiliary equipment was under

[35] The highest production under the Japanese was reached in 1942 when 49,000 tons of pig iron and 5,000 tons of raw steel were produced. This information is based on *Geological Survey of China*, Special Report 7, December, 1945, written by C. C. Pai.

[36] *Peking Radio*, March 30, 1950.

[37] *Shanghai Radio*, February 3, 1953.

construction in 1953.[38] The plant when completed will probably have a capacity of 1.2 million tons of pig iron, 1.5 million tons of steel and 1.0 million tons of rolled products.

Raw Materials

Maanshan has access by cheap water transportation to the iron ore deposits on the Lower Yangtze. The iron bearing area extends westward from Nanking about 50 miles along the south shore of the Yangtze River. The reserves contain 32.2 million tons of ore with 16.7 million recoverable iron content. The ores of most of the deposits are of high quality containing generally over 50 per cent iron and less than 0.1 per cent sulfur. The known reserves should be able to provide iron to the furnaces when they are operating at full capacity for a period of 15 years.

Coking coal could come from North China, from Kailan by ocean-going vessels carrying the coal without transfer up the Yangtze River. The Chunghsing Mine in Shantung is also a likely source for coking coal. In this case, coal would be hauled by barges on the Grand Canal until it reaches the Yangtze River, and then up the River to Maanshan. The distance from Chunghsing to Maanshan by water is 400 miles in comparison to 1000 miles from Kailan to Maanshan. Transportation advantages favor utilization of Chunghsing coal, although its quality is not as good as that of Kailan.[39] The Huainan Basin, Northern Anhui, 140 miles by rail from Maanshan, provides a third possibility. The coal is of Middle and Upper Permian Age and had been considered non-coking. The Basin contains over 700 million tons of coal located in 27 seams with an aggregate thickness of 133 feet. It was reported in 1949 by C. Y. Hsieh on the basis of exploration during 1946 through 1948 that two seams are suitable for the making of metallurgical coke.[40] Huainan colliery is equipped with mechanical mining devices, and can easily produce enough coal to meet the non-coking coal needs of the Maanshan Iron and Steel Works, though the same cannot be said for coking coal on the basis of available information.

HANKOW AREA, HUPEH PROVINCE

Two plants had been built in the Hankow Area to produce pig iron. One plant was at Hanyang near the western outskirts of Hankow. The other, at Shihhanyao (near Tayeh), some 60 miles downstream from Hankow. Both plants were located on the Yantgze River. There were two 450-ton furnaces at Hangyang built in 1891. These were shut down in 1922 and never blown in again. The Chinese in 1938 removed part of the equipment up the Yantgze River to Chungking on their retreat. The Shihhanyao plant also had two 450-ton furnaces built during 1918 through 1922. The first of these furnaces started operation in 1922, and within a month it was necessary to clean it out with dynamite because of frozen charge. Due to faulty design as well as economic problems the furnaces did not prove successful and they were closed down in 1926. The Japanese dismantled one of these furnaces and

[38] *North China News Agency*, Peking, February 7, 1954.

[39] A comparison of Chunghsing and Kailan coking coals is as follows:

	Fixed carbon	*Volatile matter*	*Sulfur*	*Ash*	*Moisture*
Chunghsing	57.4	30.3	1.5	12.2	0.7
Kailan	60.0	29.6	0.7	9.9	0.6

[40] C. Y. Hsieh: "Paikingshan Coal Field—New Discovery in Huainan Basin, Northern Anhui, Central China," *Econ. Geol.*, March–April, 1949, Vol. 44, pp. 128–142.

sent it to North China in 1944; the other was being torn down when the war ended in August, 1945.

The Nationalist Government, after the liberation of Hankow from the Japanese, formed the Central China Iron and Steel Works. The only blast furnace surviving by this time was a 75-ton-per-day unit. It was repaired and a negligible amount of pig iron was produced in 1948. Arthur G. McKee Company, of Cleveland, Ohio, after surveying the existing equipment, proposed a plant capable of turning out one million tons of ingot steel. The creation of the new factory had not reached beyond the blueprint stage when the Communists occupied the Hankow Area in May, 1949.

Various Chinese radio and press reports indicate that the Peking Government is planning to create a large, fully integrated iron and steel mill at Huangshih on the Yangtze River 55 miles below Hankow. Construction was started in the latter part of 1953.[41] The Central-South China Iron and Steel Industry Institute was organized at Wuchang to train technicians for iron and steel mills and for the iron mines. The school commenced March 31, 1953, with approximately 700 students. Hankow-Wuchang-Tayeh Area is designated as one of the future industrial centers of China. Tractor and automobile factories are planned for the area. In order to facilitate the rail and road transportation across the Yangtze River, a bridge is being built by Russian and Chinese engineers.

Raw Materials

Iron ore for Huangshih would be supplied from Tayeh. Ore would be carried by rail from the mines to Huangshih, a distance of approximately 20 miles.

[41] *People's Daily*, February 3, 1953.

Tayeh has about 45.8 million tons of high grade ore bearing 55 per cent or better iron. Tayeh mines had been worked during the early history of China; slag dumps mark the sites of native furnaces dating back to the tenth century. Under Japanese management, Tayeh shipped about 5 million tons of 60 per cent ore to Japan from 1939 through 1944. In spite of rather intensive exploitation, since 1900, of the original 20 million tons of reserves minable by the open-pit technique, about one-half is still intact. This portion of the deposit will undoubtedly be used first before large-scale underground mining begins.

Hupeh does not have coal deposits that would provide metallurgical coke. Such coal has to be carried approximately 350 miles by rail, or by rail and water combined, from Anyuan Mine (27°37′ : 113°54′) located in Pinghsiang District, Kiangsi Province. The Anyuan and the nearby Chingshanpu deposits were examined by K. C. Hsu in 1935, and he estimated the first contained 90 million and the latter 29 million tons of coal. Mining at Anyuan had depleted most of the best seams of known coal. Intensive drilling activity during 1952 led to discovery of additional reserves.[42] Modernization of mining activity started in October, 1951, when the workers were given pneumatic tools. An existing shaft was rebuilt in 1954, and construction was in progress on a second shaft and a horizontal tunnel at the beginning of 1955.

Pinghsiang coal is slightly low in fixed carbon (54.1 per cent), very high in ash (21.0 per cent), carries 0.5 per cent sulfur, and 23.5 per cent volatile matter. It yields a medium to poor coking coal. The quality may be improved by washing the coal and through blending it

[42] *Peking Radio*, January 19, 1953.

TABLE V

DISTRIBUTION OF IRON SMELTING EQUIPMENT IN SZECHUAN

Location	Blast furnaces capacity (tons)			Steel furnaces capacity (tons)			
	No.	Day	Year	Open-Hearth	Bessemer	Electric	Total
Chungking (29°34′ : 106°35′)	8	175	52,500	30,000	29,000	9,800	68,800
Chichiang (29°02′ : 106°39′)	21	78	23,400	.....	.....	600	600
Hochiang (28°50′ : 105°46′)	1	5	1,500	.....	.....	.....	.....
Yungchuan (29°22′ : 105°52′)	3	15	4,500	.....	.....	.....	.....
Fouling (29°43′ : 107°24′)	1	15	4,500	.....	.....	.....	.....
Tatsu (29°45′ : 105°45′)	1	5	1,500	.....	.....	.....	.....
Weiyuan (29°35′ : 104°30′)	1	15	4,500	.....	.....	.....	.....
Yungchaung (29°27′ : 105°33′)	1	5	1,500	.....	.....	.....	.....
Tahsien (31°16′ : 107°28′)	2	8	2,400	.....	.....	.....	.....

with anthracites from Siangsiang Area in Central Hunan.

Limestone is found in various places near Hankow. There are large deposits of it at Tayeh.

CHUNGKING, SZECHUAN

From 1939 through 1945 a number of small iron and steel works were built in Szechuan. When the hostilities with Japan were terminated, there were 39 small blast furnaces varying in size from 2.5 tons to 100 tons. Their geographic distribution is shown in Table V. In addition there were probably over 60 native furnaces.

By 1947 most of the furnaces and other equipment became idle. They had never worked very efficiently during the war. The cost of production was high, and the high carbon content (7–8 per cent) of pig iron hampered steel making. Auxiliaries of both blast furnaces and steel furnaces were so poor that design capacity was never reached.

The Communists, after their occupation of Chungking in 1950, decided to revive the iron and steel industry. Some of the furnaces were repaired and placed into operation. The quality of steel produced was inferior to accepted standards and in the construction of the Chungking-Chengtu Railroad it became necessary to haul ingot steel over 2000 miles from Anshan and roll it into rails at Chungking.[43] At Chungking the iron and steel installations, which formerly belonged to 11 different organizations, were unified under the name of "State 101 Iron and Steel Plant." The rolling mill was repaired in 1951 for the purpose of producing rails. Difficulties resulting from lack of skilled workers, inefficient equipment, lack of power, poor coke supply, inadequate management, and general confusion were gradually eliminated by experts coming to Chungking from the Capital. Between 1951 and 1953 over 1000 students and workers were sent to Anshan and Peking at the expense of the State 101 Iron and Steel Plant, some to study theoretical, others practical, aspects of ferrous metallurgy.

[43] *Peking Radio*, December 27, 1953.

Basic repairs and rationalization of operations increased the production of steel in 1953 by about 33 per cent over 1952. New by-product coke ovens replaced the former primitive coke making installations. Work started in 1954 on two new open-hearths and a large power plant.[44] It appears that the Chinese are planning to establish a modern, small-sized integrated iron and steel center at Chungking.

Raw Materials

There are three iron ore deposits within economic reach of Chungking. These are Kuangshan, 105 miles east of Chungking by a combination or river and road;[45] Chichiang, 70 miles south of Chungking by road; and Liancheichang, 187 miles northeast of Chungking by rail and road.[46] The total iron reserves in these deposits may be estimated at 16.3 million tons with 13.5 million for Chichiang, 1.8 million for Kuangshan (Pengshui), and 1.0 million tons for Liancheichang. Their metal content averages 45 per cent for Chichiang, 53 per cent for Kuangshan, and 39 per cent for Liancheichang. The cost of assembly of iron ore at Chungking is high. The size of the deposits is not large enough to warrant the building of railroads for iron ore transportation alone. When the Chungking-Kunming and the Chungking-Kweiyang Railroads are built, the blast furnaces at Chungking will be able to get additional ore from the deposits of Kweichow and Yunnan.

Szechuan Basin has large quantities of coal with reserves estimated by Y. H. Chin to be 5761 million tons of bituminous coal and 225 million tons of lignite.[47] In 1947 the National Resources Commission estimated the reserves of the Province at 3833 million, a reduction of 2153 million tons. Good quality metallurgical coking coals form a small part of the total reserves. Some of the better coke-producing coals are in thin beds averaging less than a foot in thickness which present difficulties in mining. In the Chialing River Coal Field, situated near Chungking, the presence of phosphorous requires a special treatment if the coal is to be used for metallurgical purposes. At the present time Nanchuan deposit (28°55′ : 107°02′) provides the best coking coal for Chungking furnaces.

KUNMING AREA, YUNNAN

There were, in 1949, two small plants in the Kunming Area: one located at Kunming (25°04′ : 102°41′), the other at Anning (24°55′ : 102°29′), a short distance from Kunming. The iron and steel works at Kunming were fully integrated, with one 10-ton blast furnace, three electric steel furnaces (one ½-ton, one 1-ton, one 3-ton), and a 9000-ton capacity bar mill. The plant at Anning had one 50-ton blast furnace and one 30-ton open-hearth. It is assumed that the equipment mentioned is in operation although no reference is available concerning it in the Chinese press.

Iron ore and coal are found within a 100-mile radius of the blast furnaces. Wuting iron ore deposits, with 6,000,000 tons of reserves, supply Kunming; and the five deposits of Imen, with 7,500,000 tons, provide ore to Anning. The ore in both cases is of high quality and contains over 50 per cent iron. The Kunming Area suffers from a lack of good transportation. Iron ore, limestone,

[44] *North China News Agency*, January 27, 1954.

[45] From Chungking to Fouling by the Yangtze River it is 77 miles. Kuangshan is reached by a 28-mile road from Fouling.

[46] From Chungking to Tzuchung Station the rail distance is about 160 miles; from Tzuchung to Liancheichang the road distance is about 27 miles.

[47] Y. H. Chin: *Special Report of Geological Survey of China*, No. 6, 1941, p. 2.

TABLE VI

PRODUCTION OF PIG IRON AND STEEL AND CONSUMPTION OF STEEL IN CHINA 1929–1954*

Year	Pig Iron Production			Steel Ingot Production			Imports of steel in ingot equiv.	Exports of steel ingots	Apparent Consumption
	China Proper	Manchuria	Total	China Proper	Manchuria	Total			
1929	148	295	443	20	†	20	590e	†	610e
1930	124	349	473	15	†	15	520e	†	535e
1931	136	342	478	15	†	15	520e	†	535e
1932	154	368	522	20	†	20	600e	†	620e
1933	174	433	607	30	†	30	815e	†	845e
1934	135	476	631	50	†	50	1,140e	†	1,190e
1935	166	608	774	45	137	182	1,080e	†	1,262e
1936	161	633	794	50	344	394	975e	†	1,369e
1937	145	762	807	40	451	491	975e	55	1,411e
1938	75	855	830	3	622	625	650g	55	1,220e
1939	170	1,025	1,195	8e	562	570e	750g	65e	1,255e
1940	175e	1,061	1,236e	20e	554	574e	700e	40e	1,234e
1941	155e	1,359	1,514e	26e	573	599e	440e	200e	839e
1942	200e	1,682	1,882e	35e	724	759e	240e	300e	699e
1943	203e	1,716	1,919e	57e	837	894e	230g	170e	954e
1944	278e	1,174	1,452e	64e	437	501e	100g	180e	421e
1945	†	88	†	65e	†	†	†	†	†
1946	†	†	†	†	†	†	240	†	†
1947	†	†	†	†	†	†	†	†	†
1948	†	†	†	†	†	†	†	†	†
1949	†	†	250e	10e	150e	160e	†	†	†
1950	†	†	950e	50e	600e	600e	†	†	†
1951	†	†	1,400e	150e	750e	1,900e	150e	†	1,050e
1952	850	1,050	1,900e	350e	1,000e	1,350e	300g	†	1,650g
1953	1,000	1,250	2,250e	500e	1,200e	1,750e	400g	†	2,150g
1954	1,200	1,800	3,000e	750e	1,400e	2,150e	500g	†	2,650g

*Compiled from various sources. The abbreviation "e" means estimate; "g" is largely a guess; †, no data available. The figures for China Proper are at best estimates and their reliability is questionable.

and coal have to be carried to blast furnaces by truck on bad roads in mountainous territory. Yunnan Province is not connected by rail to the rest of China. The size of the Yunnan market for iron and steel is small and cannot support an iron and steel industry of economic size even if the transportation hurdles were eliminated between the raw material producing-areas and the blast furnaces.

PRODUCTION AND CONSUMPTION OF IRON AND STEEL

Before 1939, China, excluding Manchuria, had virtually no steel production. Steel consumption in China Proper during the 1935–1939 period was so small that, if calculated on a per capita basis, it varied between two to three pounds per person. In 1949 consumption per person had fallen to less than one pound per year. The target set for 1958 is the production of approximately six million tons of steel or 20 pounds for each of the 600 million inhabitants of China. In comparison with the United States that had in 1951 a per capita consumption of 1347 pounds, or to Russia with 342 pounds per person also in 1951, the Chinese near-future goal, even if reached, appears small.[48]

Production of pig iron and steel ingot as well as figures for the foreign trade in steel are shown in Table VI. Approximate as they may be, these

[48] Figures of per capita steel consumption for some other countries for 1951 were as follows:

Canada	805 lbs.	Pakistan	9 lbs.
Mexico	80 lbs.	Philippines	17 lbs.
Chile	57 lbs.	Algeria	60 lbs.
England	611 lbs.	Belgian Congo	26 lbs.
Finland	315 lbs.	Br. East Africa	13 lbs.
Arabia	26 lbs.	Morocco	60 lbs.
India	11 lbs.	South Africa	262 lbs.
Japan	137 lbs.		

statistics reveal some interesting points some of which are as follows:

1. Pig iron production in China traditionally has exceeded the steel production. This is the opposite of the pattern in industrial countries where steel production is greater than pig iron production. The gap between iron and steel production will probably become smaller in the near future.
2. China may be shipping a small amount of pig iron to Russia to be processed and returned home. Some of the pig iron is probably used in payment for the equipment received from Russia.
3. The Chinese iron and steel industry already has gone through several expansion and shrinkage cycles (Fig. 4). Attempts in the past to build up a large steel industry have ended in failure. Though the reasons are partly economic, lack of security had played an important role, but now that political stability is established, even though it may be tyrannical, Chinese industry is making rapid strides.

CONCLUSION

While China does not yet rank with the great steel-producing nations of the world, its position is steadily gaining in importance. The Chinese steel industry is developing rapidly. This development, a remarkable performance in view of the many factors tending to restrict it, could scarcely have taken place except under the peculiar economic system prevailing in China, a system under which the government is in a position to foster the expansion of industries despite natural or economic disadvantages. Russian aid in the form of equipment, technical knowledge, and capital have also aided in the promotion of the Chinese iron and steel industry.

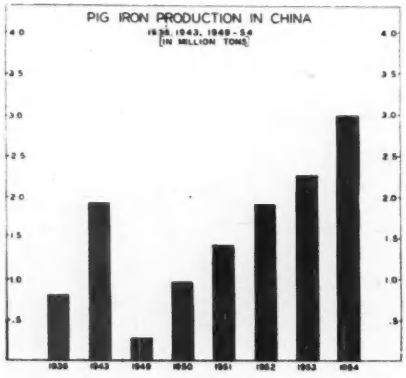


FIG. 4.

Notwithstanding the many difficulties it faces, China has one notable advantage over some of the other countries of Asia and South America. There is a vast fund of knowledge and experience to draw on from China's near past and, with the help of Russian experts, there should be no need to repeat the former mistakes. Be this as it may, Chinese leaders in their haste to create new industries have been tending to overlook some of the limitations of economic development.

The principle that the marginal efficiency of a particular factor of production is likely to decrease as its relative supply increases is not altogether valid if it is to be applied to various parts of Chinese economy. It follows, therefore, that the return on capital invested in heavy industry in China is *not* likely to be greater than the same amount invested in a country rich in capital. The initial investment of capital in the Chinese iron and steel industry may not produce any immediate return. This situation has occurred already several times in Chinese history. With the government protection for a decade or more, auxiliary industries will be built around iron and steel and the profit margins of initial capital will increase. Assuming this analysis is correct, it

follows then that there is a limit in an underdeveloped country's ability to carry an economically marginal industry. If the size of the iron and steel industry is set too high for the short term, and the six million ton goal for 1958 appears to be large, China will experience difficulties in reaching and maintaining such a target even with the aid of its Soviet comrades from Russia. Furthermore, the extra transport requirements needed to haul raw materials to the steel centers and to carry the finished and semi-finished products to the markets will create bottlenecks in transportation, retarding the pace of development.

BOOK REVIEWS

Geographical Features of the Automation of Industry, by DAVID G. OSBORN. The University of Chicago, Department of Geography. Research Paper No. 30. xiii and 106 pages. University of Chicago Press, 1953. $3.00. 9 x 6 inches.

Much has been written recently about "automation" and the coming of the automatic factory. Most of the writings have been concerned with the effects of automatic processing upon employment and productivity. Little attention, however, has been directed to the effects of automation upon other aspects of manufacturing.

To date, only one study, *Geographical Features of the Automation of Industry*, by David G. Osborn, has treated with the possible effects of automation upon the location of industry and the effects changing location requirements may have upon the economic base of cities, regions, and areas. Osborn's study presents the findings of 12 case studies in which automatic processes have been wholly or partially adopted in manufacturing and non-manufacturing activities.

The objectives of the study are to investigate the relationships between changes in process and resulting changes in space requirements, number of workers, and productivity of industry; and to assay the impact of changes in these factors upon total land requirements of industry and the economic base of cities or regions. The importance of instrument service as a factor in location of industry is also considered.

Osborn cites the iron and steel industry of England and the mechanization of agriculture in the United States as examples of how process changes have altered the location patterns of industries and economic activity.

In England, discovery of a method of coking coal resulted in diminishing importance of forested areas as a location factor and an increased importance being placed upon the coal fields. The advent of the Bessemer converter and the Siemens open hearth furnace made possible the utilization of local phosphoric ore deposits, previously useless in steel making.

In the United States, the tractor made possible reduction in number of draft animals and a reduction in manpower requirements. Also, enlarged crop areas were possible—including land previously submarginal and land devoted to production of stock feed.

In these instances of technological change the changing relationships between labor, space, and productivity resulted in a reduction of rural labor and an increased demand for urban labor. Labor's function changed from a basic power source to a fabricator and tender of machines. Osborn makes a fundamental distinction between the industrial revolution and the introduction of automation: "The industrial revolution was not so much a revolution of machines as it was a revolution of power. The introduction of power replaced man as a source of energy and cast him in the role of a machine tender. With automation the human mind is supplanted by manufactured instruments as a source of decisions required for guiding machines."

He states that there are many stimuli for automation, though it is being applied today primarily in three kinds of situations: "Where the 'type of human labor' required is such that adequate supply does not exist . . . at any price . . . ; where the 'nature of the process' is such that it is literally impossible for human beings to exercise adequate supervision or control . . . ; and where quality of requirements of the end-products are tight. . . ."

The chief obstacles to automation are: present plant investment and cost of new equipment; general inertia; traditional methods of doing things; consumer resistance to certain products and services automatically produced; obstacles to communication of new ideas to the people who are in a position to adopt them.

Other obstacles which might be added to Osborn's list are: the problem of determining which phase of the production process should be automated to give maximum economy of production; the problem of whether the sales potential of the product will be great enough over a period of time to warrant the initial cost of conversion; or whether changes in product design in certain product fields may render an automatic process obsolete soon after it has been adopted.

The significance of instrument service to users of automation and the distribution of instrument service facilities as a location factor for industries utilizing automatic control systems is discussed. The present distribution of instrument service facilities is about evenly divided between the northeastern United States, which has always had the greatest concentration of industry, and isolated cities in the West, the Gulf Coast and the South which have had a recent growth of industries readily adaptable to automation (i.e., petroleum refining, chemicals, synthetic fibers, synthetic rubber, and atomic energy).

Osborn assumes that industries capable of

being automatized will tend to locate where service facilities are already available. Isolated service centers now serving only one specialized industry may thus attract other industries, and automation service will tend to make them become centers of diversified industry. Accordingly, Osborn foresees some regional changes in the distribution of industry.

Though Osborn states the effect of instrument service on the location of producing industries is unmistakable, he presents no real evidence to support this thesis. It is the opinion of the reviewers, however, that instrument service facilities like other service facilities will tend to locate where industry is already established. The present distribution of instrument service facilities—i.e., at the points of demand—seems to support this latter view. The potency of instrument service as an independent locational attraction seems overrated by Osborn.

Osborn's over-all conclusions are concerned with the changing relationship of space, employees, and productivity resulting from automation and the impact of these changing requirements on total land requirements of industry in a city or region and on its economic base:

> "Automation thus far has had only slight effect on location. . . ."
>
> "Space (floor area or acreage) per unit of output was reduced in all cases (studied). The mean of the reductions was 58.8 percent. Number of employees per unit of output was reduced in all cases (studied). The mean of such reductions was 63.4 percent. Automation, by reducing the locational force of two of the industrial location factors, may increase the range of location possibilities."

In assaying the impact of these changes on the economic base of an area, Osborn applies these average figures to the Chicago Metropolitan Area. As a result, for example, he estimates that the 8800 acres now in industrial use may be reduced to 5300 acres (presumably within the next 20 years when ". . . all the automation which is now envisioned . . . will be attained").

Osborn's basic assumption is that there will be, as a result of automation of those industries capable of being automatized, reductions in the existing space and employment used in manufacturing and related kinds of industry. This basic assumption, however, is not wholly supported by his case studies. In each case the primary objective of automation was greater output to meet increased demand, not reduction of space or of employees. The reductions were accomplished negatively—through a net expansion. Through introduction of new processes, less space and less man-hour input were required than would have been required previously for the same unit of output. Other processes were not abandoned. The companies adopting automation were expanding; their new production was for new markets. Consequently, it is difficult to visualize any great reductions in the future over the present space and labor requirements of an industrialized area. In the case of a metropolitan area that has grown rapidly and has a diversified industrial base, however, automation should lessen previous estimates of future demand for space and employees. Thus, the effect of automation may be more in the direction of reducing the future land requirements for manufacturing rather than in diminishing the present acreages devoted to this purpose.

Dr. Osborn is to be commended for an original and much-needed study of a problem of significance to many persons. He has effectively shown that "process," a subject long neglected by most geographers, must be considered as a locational factor and in land planning for future uses.

VICTOR ROTERUS
CHARLES DAOUST

Washington, D. C.

Problemas Económicos y Sociales de los Andes Venezolanos, Parte I. 331 pp.; maps (some in color), diagrs., ills., tables. Consejo de Bienestar Rural, Apartado 2797, Caracas, Venezuela, 1955. 12½ x 9 inches.

The Consejo de Bienestar Rural has just brought out the impressive volume *Problemas Económicos y Sociales de los Andes Venezolanos, Parte I*, in which is presented some of the material gathered by a group of Venezuelan and American social scientists under the direction of Professor Henry S. Sterling, Department of Geography, University of Wisconsin.

A brief discussion of historical high lights and of the physical and cultural aspects of Venezuela's three Andean States is followed by a detailed analysis of economic and social problems. Land tenure systems, nomadic patch agriculture, grazing, and commercial agriculture are exhaustively treated in Chapter III.

A thorough analysis of the entire agricultural economy is made in Chapter IV, from land tenure and its influence on land use practices to the bases of capital formation. Both latifundio and minifundio exist, with their concomitants of renters, sharecroppers and casual laborers, or of owner-operators of plots so small as to be farmed on an uneconomic basis. Forestry, mining, commerce, and industry are treated in Chapter V.

It is strongly recommended that more money be spent in experimental studies in the growing of coffee, sugar cane, and bananas. It is felt that efforts to increase production per unit area must go hand in hand with efforts to increase the amount of land available for those now cultivating farms less than 12½ acres in

extent. Especial emphasis should be placed on increasing efficiency in the field of animal husbandry. It is further recommended that facilities for the extension of cheap and easy credit be made available, that areas not yet settled be opened up, and that farmers in certain "depressed" sectors be resettled in areas outside the Andes.

This is a magnificent volume. It is heartwarming to realize that the material gathered by this group of scientists is organized and published and not allowed to gather dust in official files. Scientists, public servants, and officials of private concerns, all deserve credit for the teamwork displayed, for, together with the artists, photographers, draftsmen, and printers, they have achieved a well-balanced, highly-readable, superbly-illustrated volume.

RAYMOND E. CRIST

University of Florida

Economic Geography of West Africa, by F. J. PEDLER. xii and 232 pp.; maps, diagrs., ills., index. Longmans, Green & Co., London, 1955. $3.25. 8½ x 5½ inches.

Mr. Pedler's book is most timely in its appearance. Two of the four British territories in West Africa (referred to in the book as the "Four Countries") are proceeding rapidly towards the goal of self-government. When this is achieved political stability will depend in no small measure on the degree of economic well-being that is maintained.

There is certainly some element of truth in the belief that recent political progress has outstripped economic developments, great though the latter have been in the post-war years. The limited range of export products from the "Four Countries" make their economies highly vulnerable to fluctuations in the world markets, a fact of the greatest importance but one which is not particularly stressed in this book. For many years these products have found a ready sale with a resulting wave of economic prosperity, but there have been ominous signs that this may not continue indefinitely. It is most important that people in and outside West Africa should understand the basic elements in the economy of the territories. The author has made a significant contribution to such an understanding. After reading his book it is possible to turn to more detailed studies of recent years of West African trade, of the national income and economic development of Nigeria, and of the problems of industrialization in the Gold Coast with an increased capacity for appreciation. And these are documents of the greatest importance for future economic planning.

When he is writing of economic facts and factors Mr. Pedler is at home with his subject, and he is at his best when he treats of the highly complex economics of small-scale internal trading. For example, he gives a first-class account of the sale and purchase of groundnuts (peanuts) and the function of middlemen. But he is not a geographer and one can feel that he is himself conscious of the fact and that there is a certain diffidence on the occasions when he uses the term "economic geography." For when all is said and done he has not written a study of economic geography of West Africa but a study of West African economy, with particular reference to the "Four Countries" though information on the French territories and Liberia is not lacking. As such the book is good, and more particularly the second half which deals with "economic functions."

Unfortunately, the same cannot be said of the first half, and especially of the opening chapters which present "basic geographical facts." Generally speaking the handling of the environmental material is unsound. It is unlikely that a geographer, outlining the environmental background for a study of the economic geography of West Africa, would feel it necessary to refer to and illustrate the movements of the earth relative to the sun. The author has done so here, and one suspects that he does not fully understand the rotation and revolution of the earth. Some of the errors of fact and the poor expression that occur in these pages should have been eliminated in the early readings of the author's manuscript. There are examples of implied determinism which one feels the author does not realize. The relationship of cause and effect in rainfall and vegetation is clearly not understood. In the case of the lower rainfall areas of West Africa the effectiveness of the precipitation is determined more by the incidence than by the total amount. There is pressing need for the revision of these first three chapters.

There are errors also in the section on population. On the first page it must be noted that both the Gambia and Sierra Leone have higher densities than the Gold Coast which is ranked second to Nigeria, and the population of Sokoto Province in Northern Nigeria very definitely concentrates in and near to the river valleys, to the extent of about 80 per cent of the provincial total. In this chapter the author defines economic geography as the study, in its economic aspects, of the relationship of the distribution of population to physical geographical facts and expresses this in "a simple equation."

$$\text{Man} + \text{Soil} + \text{Climate} + \text{Pests} = \text{Type of Economy}$$

One may not be prepared to accept this expression wholeheartedly, but less cause for criticism in general would be found if the author had followed it out in his approach. Then he would have written something more nearly approaching an "Economic Geography of West Africa."

But apart from the major criticism of content in respect to the title of the work, for the latter is truly misleading, there is much for which we must be grateful to Mr. Pedler. There is, for example, his treatment of the problems of industrialization and his explanation of the functioning of the much criticized Marketing Boards which handle the major agricultural exports and are "the most powerful influence in the economic life of the Four Countries." He is not without errors in the well written sections of the book, but these are minor and he maintains most commendably an objectivity in his presentation of facts. Statistics quoted are certainly the most recent available, especially in view of the fact that some West African government departments are notorious for a time-lag in the publication of reports.

Geographers cannot but read this book critically for the reasons stated; they will find the maps disappointing and the photographs (five in color) of general economic interest. However, for those interested in West Africa, and for that matter in tropical areas in general, it is a work that should not be ignored.

R. MANSELL PROTHERO

University of Liverpool

Land Property and Land Tenure in Italy, by GIUSEPPE MEDICI. 246 pp., maps, tables. Istituto Nazionale di Economia Agraria (printed by) Edizioni Agricole, Bologna, 1952. 3500 lt. lira ($6.00 U.S.). 9¼ x 6½ inches.

In this somewhat abridged English edition of his work in Italian Professor Medici surveys agriculture in Italy from the point of view of regional distribution of landed property, and of types of farm enterprise, with an excellent and succinct historical account of land holding. After an extremely detailed statistical analysis of many factors, including size of holdings, category of worker and of agricultural enterprise, and so on, the author concludes that, although capitalist holdings employing wage labor occupy less than 11 per cent of the total arable area, it is on the best lands, the most fertile and productive, that this type of farm organization prevails. It is impossible to do justice to this meaty volume in a short review, but the author finds the conclusion inescapable that, in general, although small operator-ownership is at present widespread, particularly in the tree-planted coastal lowlands, land monopoly in the interior parts of southern Italy and Sicily has retarded evolution towards modern systems of farming

RAYMOND E. CRIST

University of Florida

Economic Survey of Montgomery and Prince Georges Counties, Maryland, by HOMER HOYT ASSOCIATES. vii and 309 pp.; maps, tables. The Maryland National Capital Park and Planning Commission, Silver Spring, Maryland, 1955. $4.05. 11 x 8¾ inches.

This survey is the last of three studies prepared by Homer Hoyt Associates covering the suburban counties of the Washington, D.C., Metropolitan Area. The volumes on Arlington and Fairfax Counties, Virginia, were completed in 1951 and 1954, respectively. The latest volume was sponsored by the Maryland National Capital Park and Planning Commission in conjunction with the Montgomery County Council and the Prince Georges County Commissioners.

Although the title *Economic Survey* is more comprehensive than *Economic Survey of Land Uses* (the title used for both previous publications), this is still too limited a claim. Included are not only such considerations as the values of houses, assessments of real estate, and costs of county services, but also much material on population growth, racial composition, types of dwelling units, and patterns of the various phenomena. Here is subject matter for the sociologist and demographer as well as for the economist, while throughout there is substantial fare for the geographer.

The appeal to the geographer is not surprising considering the background of one of the principal investigators and author of several chapters, Dr. Jerome P. Pickard, a geographer who is presently Research Director of the Economic Development Department of the Washington Board of Trade. Dr. Pickard's chapters are among the best in the book, particularly Chapter V, "Population Characteristics," and Chapter VI, "Patterns of Land Use." Pickard's work is felt through much of the volume, and he was responsible for the major maps on land use and land value. This well-handled presentation and analysis of socio-economic data in developmental and spatial aspects exhibits a happy working arrangement between a geographer with a bent for economics and an economist, Homer Hoyt, of no small reputation among geographers.

The study was designed to help the two suburban counties in their planning for the future. About half the space is devoted to tables of statistics, often showing information by decades since 1890. This has been a good job of data collecting and sound analysis. Methods used here, such as that for "the separation of present or prospective urban areas from areas expected for some time to remain agricultural and rural" and for the comparison of population composition and trends for different areas, should be of interest generally to students of urban problems and development.

Interesting developments in the Washington

area are brought sharply into focus. For example, the suburban counties have experienced an immigration of young white families from the District of Columbia, while the percentage of non-white people in the District has been steadily increasing. Meanwhile, the white population of the District of Columbia has shown a tendency to be composed more and more of older or single persons.

The wedge-shaped or sector pattern of urban development in the Washington Metropolitan Area is emphasized by house values and income statistics. Montgomery County in general continues the area of northwest Washington where the higher-priced houses and higher incomes prevail; Prince Georges County shows extentions of lower economic status areas within the District. Neither county, however, has extensive blighted or slum areas.

A series of maps shows main business districts of the two counties. It is noted that, despite emphasis on parking facilities, there is a shortage of parking space in the principal districts. In spite of considerable growth of these outlying areas, the great bulk of general merchandise and department store sales in the Washington Metropolitan Area is found to be still in the District of Columbia.

In a consideration of the industrial potential of the Washington area, the usually careful treatment seems weakened by such an unqualified assertion as the statement that "The greatest expansion in American industry in the last two decades has been in the South and West." Certainly in the period since the outbreak of the first World War, expansion in manufacturing, as expressed by persons employed therein, has been far greater in the Northeast than in any other section of the country.

In many instances throughout the volume, statistical data is presented on the basis of election districts, and the division is made between "rural" and "urban" districts. Unfortunately, the basis for the distinction is never clearly made.

Predictions of future conditions are tempting targets for criticism. In this particular study, the impression is sometimes given that more accuracy might be read into two-decimal place percentages than an uncertain future would allow. For example, in assessing the future of the Wheaton district, the statement is made that "Its rate of growth will still hold to a high level for the 1950–1960 decade—102 percent, but thereafter as it too reaches maturity, the increase will drop to 12.28 percent for the 1960–1970 decade and to 3.42 percent for the 1970–1980 period."

Nevertheless, such predictions of growth, of future school needs, of urban land requirements—are carefully calculated from past and present information. This is no simple collection of voluminous statistics but a thoughtful analysis of present conditions and future needs based on a wealth of accumulated data. The study thus provides a logical basis for planning and further research in the counties investigated, and should be of value to those concerned with problems affecting cities and their urban fringes.

RICHARD E. MURPHY

George Washington University

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